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THE BRICKBVILDER

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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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THE IRELAND DISASTER.

FROM the mass of details that the daily newspapers have given us, in connection with the fall of the Ireland Building in New York, one truth stands out conspicuous,— the inefficacy of law to procure safe buildings.

Not the least interesting fact in our present half-baked age, to the members of a future and higher civilization, looking back upon the development of the intellect at the close of the nineteenth century, will be our fond trust in legal enactments to obtain our desires, regardless of the physical and logical possibilities of the case.

Philosophers have preached, with the applause of the galleries, but with the comprehension of only a few in the audience, the function and scope of government, pointing out that the greatest possible liberty of action for the individual was the condition of social progress and ultimate perfection, and that the only possible function of government consistent with further development of mankind was to maintain this condition of greatest possible liberty for all.

Quite recently the New York *World* devoted a whole issue to the defense of liberty, quoting Herbert Spencer, John Stuart Mill, Buckle, and the rest of the thinkers upon that topic, to support its demands, and very proper demands, for the removal of legal restrictions upon the liquor traffic, but without indication of any comprehension that the same principle applied to all departments of human activity.

Now, if this office of defense against aggression be admitted as the only office of government, the only case where governmental agencies could properly interfere with buildings at all would be where somebody had erected a building with the intention of causing it to fall upon others or had deliberately destroyed a building in order to injure the inhabitants. Even manifest insecurity is not aggressive, as long as others are not compelled to risk their lives in or near the dangerous building, and damage to the property of others, in case of a fall, is made good.

These conditions, however, do not occur. People do not build with any desire that their buildings shall fall, nor, except in war, which is a temporary relapse into savage conditions, do they destroy buildings maliciously. Everybody who builds is extremely anxious that his building shall be entirely secure, because it is very much to his interest that it shall be so.

As it is logically impossible for a liberty-defending government to restrict or revenge any but malicious damage done by builders, it is also physically impossible for a paternal government like ours to force its members into attending to their own interests better than they could attend to them unrestricted.

For consider what this matter of governmental supervision means.

It means that each architect shall have an angel guardian in brass buttons at his elbow to tell him just how to make every detail of his design. The present number of inspectors is totally inadequate to do this.

Architects will average at least two or three jobs at the same time. Work upon these while they are in progress goes on continually. General drawings, which now have to pass the Building Department, are followed by larger drawings of all parts in detail: framing plans, flue drawings, sidewalk vault drawings (which, by the way, are outside of the scope of the Building Department now, yet are, perhaps, more strongly built than any other part of the building), steam-boiler arrangements, drawings for elevators, schemes for high pressure electric work, and so on, a mountain of expert detail which cannot be minutely criticized by any one man, over which one man can exercise only general control, which must be handled by a system of hierarchical subordination and responsibility.

Then, when it comes to the supervision of the work in execution, it is equally impossible for an architect to know what goes on in particulars. If an architect has specified a proper thickness of concrete, for an instance, he has given his instructions, given them, moreover, in writing, and if the failure to comply with these instructions escapes his attention, the responsibility for results is upon him whose business it was to carry out the instructions. An architect is a guide and counselor, not a detective. Although it is his business to see that his design is properly carried out, he is not properly responsible for the failure of others to do as he tells them, and to do it in a good, sufficient, and workman-like way.

Although this sounds like heresy to those who flatter themselves that they can get a very cheap contractor, and that it is the business of the architect to make him do good work, it is backed by that most potent of arguments, — common sense. Everybody knows that it is impossible for an architect to spend all his time on a job; that visits, more or less frequent, are all that can be reasonably demanded. How is he to be responsible if his instructions, given during his visit, are disregarded the moment he has departed. Even if, as is often done on large buildings, he keeps a superintendent on

the building all the time, how is the superintendent to be in all places at once? While he is hammering iron columns to detect flaws at one side of the building, a mason's gang at the other side may be bedding foundation stones with only a rim of mortar; while he is watching the completion of the roof, the cellar concrete may be going down half the thickness specified.

When we talk of governmental inspection securing perfection in details, we might as well remember that it would require not only an inspector apiece for each architect, but an inspector of each gang of workmen on every building in progress.

Better, while we are about it, abolish architects entirely and let the whole building business become a governmental bureau.

But reason is useless against that which is not founded upon reason. The superstitious confidence in law, which we still retain as part of our nature, is but a survival of the ancient spirit of subordination to monarchical control which will not breed out for some generations to come; we venture this expostulation to aid the process of breeding out, not in any hope of working perceptible change in the course of events.

Yet there may come a revulsion sooner than might be expected. People are beginning to object to the rapidly growing number of office-holders which is needed to carry out their continual demand for more laws and more complete enforcement of laws. They will gradually come to understand that laws cannot be carried out without office-holders to carry them out; that each revision and intensification of law requires the appointment of still more office-holders, reveals further defects, to remedy which there must be more laws, to carry out which there must be more office-holders, ending in a wholly Russian state of governmental control, and a total loss of inventiveness, initiative, and sense of responsibility in the people.

They will come to understand that without the false confidence begotten of supposed governmental control owners would not dare to employ incompetent architects, nor would architects dare to permit any but trustworthy contractors to be employed; that if we give to all, architects, owners, and contractors, full scope for their ingenuity in finding the best and cheapest ways of doing things and hold them responsible only for damage that may result, — the contractor responsible for properly carrying out the instructions of the architect, the architect for giving proper designs and instructions, the owner for employing competent agents, whether architects or contractors, — we shall at one blow secure safer buildings and check the growth of the office-holding class which already threatens our political institutions.

COMPETITION.

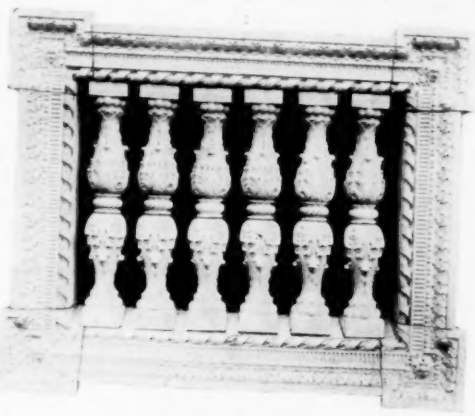
WE are authorized by the New York Architectural Terra-Cotta Company to announce a competition for the best design for a full-page advertisement to be used in THE BRICKBUILDER. The drawings must be made in line with black ink on sheets cut to the uniform size of 14 by 18 ins. For the best designs there is offered a first prize of $50, a second prize of $25, a third prize of $15, and a fourth prize of $10. The prizes will be awarded by a jury of three architects of acknowledged reputation. Each drawing must be marked with a motto or cipher, and a sealed envelope similarly marked containing the full name and address of the designer must accompany the drawing. These envelopes will not be opened until after the award is made. The designs for which prizes are awarded will become the property of the New York Architectural Terra-Cotta Company. THE BRICKBUILDER reserves the right to publish the successful designs. Other drawings, at the conclusion of the competition, will be returned to the competitors. Drawings must be delivered flat, express or postage prepaid, at the office of THE BRICKBUILDER not later than October 1.

THE program of the Wm. Connors competition for a design for an advertisement in THE BRICKBUILDER may be found on page 201.

OUR ILLUSTRATED ADVERTISEMENTS.

THE church of S. Francesca Romana, Rome, is the subject of this month's illustration in the advertisement of the Hydraulic-Press Brick Company, which appears on page xix. The body of this church and the campanile belong to the ninth century. The façade shown in the illustration is a late Renaissance structure. As stated by the inscription over the door, the date of this façade is 1620.

On page xviii, in connection with the New York Architectural Terra-Cotta Company's advertisement, will be found an illustration of the façade of The Garrick (formerly Harrigan's) Theater, on 35th Street, near Sixth Avenue, New York City. Mr. F. H. Kimball is the architect of this very ornate and altogether successful combination of form and color in terra-cotta and brick. It is considered one of his happiest efforts, both in design and construction.



Many of the dramatic creations and characters associated with the former management have been enduringly depicted along the frieze and elsewhere blended with the more severely architectural detail, as will be seen by the adjoining plates.

In the advertisement of the Eastern Hydraulic-Press Brick Company (see page xx) is illustrated the Syndicate Building, New York City.

The Atwood Faience Company (see page xvii) illustrate a mantel designed by J. A. Schweinfurth, and executed in faience.

An interesting illustration is that which appears in the advertisement of The Celadon Terra-Cotta Company, Charles T. Harris, lessee (see page vi). The illustration is of twelve plates showing the same square of tile at different angles, also a variety of light and shadow effects.

ENAMELED BRICK OR CEMENT?

THE lack of economy can so seldom be described as a dangerous quality that when public officials undertake to save the pocket-books of their constituents it is, as a rule, safer to praise than to blame; but at times and places economy may cease to be a virtue. Such a condition seems threatened in connection with the Boston subway. A prominent news item in the *Boston Herald*, a few days since, made the statement that the subway commissioners are seriously considering the use of cement or concrete in some form as a facing for the interior surface of the subway walls and presumably of the vault. There is a peculiar quality running through nearly all of our public work, which, for lack of a better name, is designated as

New England thrift, and which is manifested by an intense desire for economy in first cost and a preference for what is merely "good enough," rather than for what is the best, so that when a public official feels upon his shoulders the burden of responsibility for a building, an aqueduct, or a subway, apparently the paramount consideration is to keep down the cost. Fortunately, we have in Boston an example of the opposite spirit in the case of our Public Library, which was first made right, and then the city was called upon to pay the bills. Now, we would not be understood as advocating in the faintest degree recklessness of expenditure; but, on the other hand, no public work should be marred in its completeness by mere consideration of cost, when a cheaper method or material implies a less satisfactory and complete piece of work; and in the case of the subway it is earnestly to be hoped that the commissioners will not consider anything like concrete or cement for a facing. The material which has been thought of all along in this connection is vitreous enamel in some form, presumably in the shape of glazed or enameled bricks, and it will be a cause of great regret if the commissioners consider that their duty is to make the subway simply inexpensive.

Cement as a facing material is so obviously inadequate that the objections must appeal to every candid thinker. Cement will stain badly under any conditions when exposed to weather, unless constantly protected by coats of paint or other surface treatment. It is about as bad a surface for collecting dirt as can be devised. In case of any break in its surface it is almost impossible to patch it without showing an ugly scar, and that breaks are almost sure to occur every one will acknowledge who has undertaken to face an underground wall with cement. The dampness is bound to work through from the back, and in time will peel off the coating, whether applied to brick or stone. In fact, the only advantage of concrete would be cheapness, an uncertain advantage in the long run, when we consider the annual charge for repairs and repainting; though the difference in first cost is quite considerable, glazed brick costing fully fifty cents per square foot, while cement need not exceed ten cents per square foot. But, on the other hand, enameled brick is thoroughly clean and is very easily kept so. It is practically indestructible; it cannot peel off, and it is an integral portion of the wall itself, and, consequently, stronger than any facing could be. Furthermore, it offers an opportunity for a very pleasing treatment of what might otherwise be a dark, gloomy vault. A great deal has been said in the past about the attractive appearance the subway is to present. An artistic effect is perfectly possible and can be obtained with comparative ease by the use of tiles or enameled brick, while it is simply out of the question with almost any other material.

Why can we not learn a little from what has been done elsewhere under similar conditions? In nearly all of the European capitals where it has been found expedient to build subways for the accommodation of the public enameled brick in some form has invariably been used and always with pleasing success, and it is a very poor argument in favor of cement that it is simply cheaper than the brick. The subway is not being built to save money, but to accommodate the people in the best possible manner consistent with reason, and even were the cost of enameled brick a great deal more it is so emphatically the material for the place that nothing else ought to be considered.

This may seem like an undue insistance upon an unofficial paragraph in a daily paper, but the subway is to be built for all time, and it would be neither advisable nor likely that enameled brick could be substituted at a later date, should the deliberation of the commissioners now result in the use of concrete. It is not an unimportant matter. Boston ought to take a pride in having a subway which is not only built reasonably, but built well and thoroughly, and with the best material at the command of the builder; and, though a newspaper reporter may find great charms in a "finish almost equaling in beauty the white enamel," a little consideration will make every practical reader appreciate that the bright, cheerful effect which has been promised can be obtained only by the use of enameled brick.—*Bostonian.*

BRICK AND MARBLE IN THE MIDDLE AGES.

G. Edmund Street.

CHAPTER VIII.—*Continued.*

FOR a building which owes its general impressiveness entirely to the uniform character of its architecture, it is especially fortunate that there should be so much also in the detail to attract and reward constant and minute examination. It is for this reason that the range of great capitals to the columns of the lower arcade is of so much importance. They are so large, so close to the eye, so interesting in their story, and on the whole so carefully and artistically executed as to afford the greater pleasure the more the building is known. The key-plan to these capitals which I give will be useful to show what the general arrangement of the subjects is.

APPENDIX.

CATALOGUE OF THE SUBJECTS OF THE SCULPTURED CAPITALS IN THE LOWER STAGE OF THE DOGE'S PALACE, VENICE.

THE capitals are numbered as in the accompanying key-plan, beginning at the south-east angle on the Molo front, and going from right to left until the last capital, near S. Mark's, is reached. For those who wish for something more than a catalogue, I need hardly say that in the latter portion of the second volume of the 'Stones of Venice,' Mr. Ruskin has given all that can be desired, with his usual felicity and beauty of verbal illustration.

In the 'Annales Archéologiques,' vol. xvii. (1857), Mr. Burges has given a very full and careful account of all the capitals, to which M. Didron Ainé has added some supplementary notes.

Zanotto ('Il Palazzo Ducale di Venezia,' vol. i., pp. 209–355) has given a still more full description, accompanied by rather rude outlines of all the lower range of capitals. There is small need, therefore, for anything more than a mere catalogue here, which it seems to me may be of service to some of those who are able to look at the Ducal Palace, but unable to carry with them any of the weighty volumes to which I have referred.

South-east Angle.—Above the capital is the Drunkenness of Noah. Above this, on a level with the traceries of the upper arcade, the Archangel Raphael, with Tobit, who bears a scroll with these words—

EFICE Q̄
SO . FRE
TV . RAFA
EL . REVE
RENDE
QUIETU.[1]

Capital I. Partly built up. Has three figures of nude children, one with a comb and shears, another with a bird. The foliage is good; but the nude figures have the appearance of semi-Renaissance work.

II. Partly built up. Large birds—one devouring a serpent, another a fish, and the third pluming its feathers. The foliage here is not very good, and the design of the capital in no way first-rate, the birds being treated in a very naturalesque way.

III. Partly built up. Large heads, male and female. The man has a helmet, partly of plate, but with chain mail round the neck.

IV. Partly built up. Children, nude, holding (1) a bird, and (2 and 3) fruit.

V. Partly built up. Emperors. This is the first capital which

[1] "Oh, venerable Raphael, make thou the gulf calm, we beseech thee!" This figure looks toward the sea and the port.

has inscriptions. Those visible are (1) TITUS VESPASIAN IPAT; (2) TRAJANUS INPE; and (3) (OCT)AVIANUS IPATO.

VI. Partly built up. Large heads, alternated with tufts of foliage, badly carved.

VII. Virtues and Vices. (1) Liberality; inscribed LARGITAS. ME . ONORAT. (2) Constancy; COSTANCIA . SU . NIL . TIMES. (3) Discord; DISCORDIA . SU . --- DISCORDANS. (4) Patience; PATIENTIA . MANET . MECUM. (5) Despair; DESPERACIO . MORS . CRUDELIS. (6) Obedience; OBEDIENCIA . A . DNO . EXIBEO. (7) Infidelity; INFIDELITATE. — ILI . GERO. (8) Modesty; MODESTIA . ROBU OBTINEO. This capital should be compared with No. XXVIII The foliage here is very beautiful; but the execution of No. XXVIII. is best.

VIII. Monsters, generally with musical instruments. A riding figure here wears chain armour. There are no inscriptions on this capital, and its intention is very obscure.

IX. Virtues. (1) Faith; FIDES . OPTIMA . IN . DEO. (2) Fortitude; FORTITUDO. 'SUM. VIRILIS' (Mr. Ruskin), or 'INVINCIBILIS.' (3) Temperance; TEMPERANTIA . SUM . IN . OMIBU. (4) Humility; HUMILITAS . ABITAT . I . ME. (5) Charity; KARITAS . DEI . MECU . EST. (6) Justice; REX . SUM . JUSTICIE. (7) Prudence; PRUDENTIA . METIT . OIA. (8) Hope; SPE . HABE . IN . DNO. The differences between this capital and No. XXIX. are very slight. In the latter, Prudence has a book, which she has not here; and Temperance has a jug here in addition to the chalice which the other carries.

X. Vices. (1) Luxury; LUXURIA . SUM . IMENSA. (2) Gluttony; GULA . SINE . ORDINE . SU. (3) Pride; SUPERBIA . PREESSE . VOLO. (4) Anger; IRA . CRUDELIS . E . IN . ME. (5) Avarice; AVARITIA . ANPLECTOR. (6) Idleness; ACCIDIA . ME . STRIGIT . (7) Vanity; VANITAS . IN . ME . HABUNDAT. (8) Envy; INVIDIA . ME . COBVRIT. This capital is very finely sculptured.

XI. Birds. Some web-footed, some not so; and with no inscriptions.

XII. Virtues and Vices. (1) Misery; MISERIA. (2) Cheerfulness; ALACRITAS. (3) Folly; STULTICIA . E . REGNAT. (4) CASTITAS (CE)L(EST)IS . E. (5) Honesty; (HO)NEST(ATEM . DILIGO). (6) Falsehood. (7) Injustice; INJUSTICIA . SEVA . SU. (8) Abstinence; ABSTINECIA . OPTIMA . E. This capital is so much damaged as to be hardly intelligible without comparison with No. XXXIII.

XIII. Lions' heads, large and coarse, and with very poorly carved tufts of foliage between them.

XIV. Wild animals. The whole of the beast, not the head only, is given. They are poorly carved and designed.

XV. Damsels and Youths. Considered by Selvatico, and after him by Mr. Ruskin, to represent Idleness. There are no inscriptions. More probably they represent the youth of the higher class with marks of their sportive occupations. This is an extremely well-carved capital.

XVI. Eight large heads alternately with tufts of foliage. The whole finely carved and designed. Supposed by Zanotto to represent the foreigners who traded with Venice. Selvatico describes it as representing Latins, Tartars, etc., and as being, in fact, a repetition of No. XXIII. (*vide infra*).

XVII. Philosophers. This is very much damaged, and the inscriptions are nearly destroyed. (1) Solomon. (2) Priscian. (3) Aristotle. (4) Tully. (5) Pythagoras. On a label carried by this figure Mr. Burges reads the date 1344. Mons. Didron interprets it 1399; this is a date, however, which he will not admit, believing the real date to be 1299. Mr. Ruskin does not appear to have seen these figures, and I have been unable to satisfy myself about them.

XVIII. This is the angle capital. Above it is the Temptation of Adam and Eve; and on the second stage, the four winds on the capital of the arcade, and the Archangel Michael above. The whole is a perfectly beautiful group of sculpture, of an equally beautiful and well-selected story.

Planets. (1) Creation of Man; DE . LIMO . DS . ADA . DE . COSTA FORMAVIT . ET . EVA. (2) Saturn; ET . SATURNE . DOMUS . EGLOCERUNTIS . ET . URNE. (3) Jupiter; INDE . JOVI . DOMA . PISCES . SIMUL . ATQ . CIRONA. (4) Mars; E . - - - ARIES . MARTIS . ET . ACU - - - E . SCORPIO . PARTIS. (5) The Sun; EST . DOMU . SOLIS . TU . QUOQ . SIGNE . LEONI. (6) Venus; LIBRA . CU . TAURO . VENUS . - - - T . PURIOR . AURO. (7) Mercury; OCCUPAT . ERIGONE . STILBONS . GEMIUQ. LACONE. (8) The Moon; LUNE CANCER . DOMUT . PBET . I . ORBE SIGNORIO. The whole of the sculpture of this capital deserves careful study. Mars is a figure in chain mail. Venus, seated on a bull, and the Moon — a female figure in a boat, with a crescent in one hand and a crab in the other — are both of them exquisitely treated.

XIX. Artificers. Figures alternately crowned and uncrowned working at parts of a building. The foliage is admirable. The pieces of stone on which the artificers are at work are inlaid with porphyry. Mr. Ruskin points out that all the architectural details represented are such as would be found in the early part of the fourteenth century. It is certainly very curious that among the workers one has 'DISCIPULUS OPTIMUS,' another — 'DISIPULS INCREDUL," over the head: a reference to S. John and S. Thomas, which is not intelligible to me.

XX. Beasts. Eight large heads, well carved, and set as knops below masses of rather heavily treated leaves. The beasts have their names inscribed: LEO. LUPUS. URSUS. MUSIPUL. CHANIS.[1] APER. GRIFO. VULPUS.

XXI. Trades. Finely carved. Inscriptions over the heads of the workmen: (1) LAPICIDA SUM. (2) AURIFICES. (3) CERDO SUM. (4) CARPENTARIUS SUM. (5) MENSURATOR. (6) AGRICHOLA. (7) NOTARIUS SUM. (8) FABER SUM.

XXII. The Ages of Man. A very interesting capital. (1) + LUNA . DNAT . IFANCIE . P . ANO . IIII. (2) MECUREU . DNT . PUERICIE . P . ANO . X. (3) ADOLOSENCIE. (VEN)US . P . AN . VII. (4) INVENTUTI . DNT . SOL . P. AN . XIX. (5) SENECTUTI . DNT . MARS . P . AN . XV. (6) SENICIE . DNT . JUPITER . P . ANN . XII. (7) DECREPITE . DNT . SATN . UQ . AD . MOTE. (8) ULTIMA . E . MORS . PENA PECATI.

XXIII. Nations. This is treated in the same way exactly as No. XX. The heads are inscribed, LATINI. TARTARI. TURCHI. ONGARI. GRECI. GOTI. EGICY. PERSII. It will be found that, counting from the south-west angle, the second and fifth capitals on each front are of the same description, i. e. Nos. XIII. and XVI. on the west side, and XIX. and XXIII. on the Piazzetta-front. I think this militates against Mr. Ruskin's view that this capital is not old, as it shows how very regularly they are placed; and I do not see much to choose between in these four capitals. It is worth notice here that this capital is, to a considerable extent, a replica of No. XVI.; but the latter has no inscriptions.

XXIV. Love and Marriage. This is a much larger column than the others. It carries a cross wall above, so placed as to allow of rooms on the sea-front, about sixty-three feet in width. It is one of the most exquisite of all the series. The subjects are: (1) A young man with his hand on his heart, admiring a damsel. (2) They meet and converse. (3) She puts a crown on his head, and presents him with an apple. (4) They embrace. (5) The marriage bed. (6) They hold their bambino wrapped in swaddling clothes between them. (7) The child grows, and enjoys life. (8) The child is dead, and his parents mourn over his body. The change in character from the extreme smartness of dress in the earliest subjects to the carelessness about it in the last, should be observed.

Above this capital is a figure of Venice personified, in one of the divisions of the tracery. She is seated on lions' backs, with her feet above the sea.

XXV. Labours of the Months. This is not a replica. (1) March; MARCIUS. CORNATOR. (2) April and May; APRILIS + MAGIUS. (3) June; JUNIUS . CU . CERISIS. (4) July and August;

[1] Mr. Ruskin founds an argument on the introduction of an H in this way, in what he calls one of the Renaissance capitals of the Piazzetta (the 33rd). He omits to notice its use in this undoubtedly early capital.

JULIUS + AUGUSTU. (5) September; SEPTEBE . SUPEDITAT. (6) October and November; OCTOBE + NOVEMBE. (7) December; DECEM - - - CAT SUUM. (8) January and February; JANVARIVS + FEBRUARU.

XXVI. Sports and employments of damsels and young men. This is a replica of No. XV. The foliage here is exquisitely carved. There are no inscriptions. The figures, as in the other, hold: (1) A horse. (2) A bird, and the leg of a larger bird (hawking?). (3) A distaff. (4) A dog. (5) A flower. &c. &c.

XXVII. Fruit in baskets. This is not a replica. It is the finest of the "knop" series of capitals. The fruit is admirably carved, and here the exact imitation of nature in the fruit, combined with foliage in the knops between the baskets, which is quite conventional and architectural in its character, is extremely interesting and instructive, as showing how distinctly the sculptor knew the proper limits of conventional and realistic representation. The fruit are described: (1) Cherries; SEREXIS, (2) Pears; PIRI. (3) Cucumbers; CHOCUMERIS. (4) Peaches; PERSICI. (5) Gourds; CUCHE. (6) Melons; MOLONI. (7) Figs; FIGI. (8) Grapes; HUVA.

XXVIII. Virtues and Vices. This is a replica of No. VII. The differences are very small. Here H is prefixed to the "ONORAT" of the other capital.

XXIX. Virtues. A replica of No. IX.

XXX. Vices. A replica of No. X., but well deserving study.

XXXI. Monsters. A replica of No. VIII., but very rudely carved, and very inferior to the next.

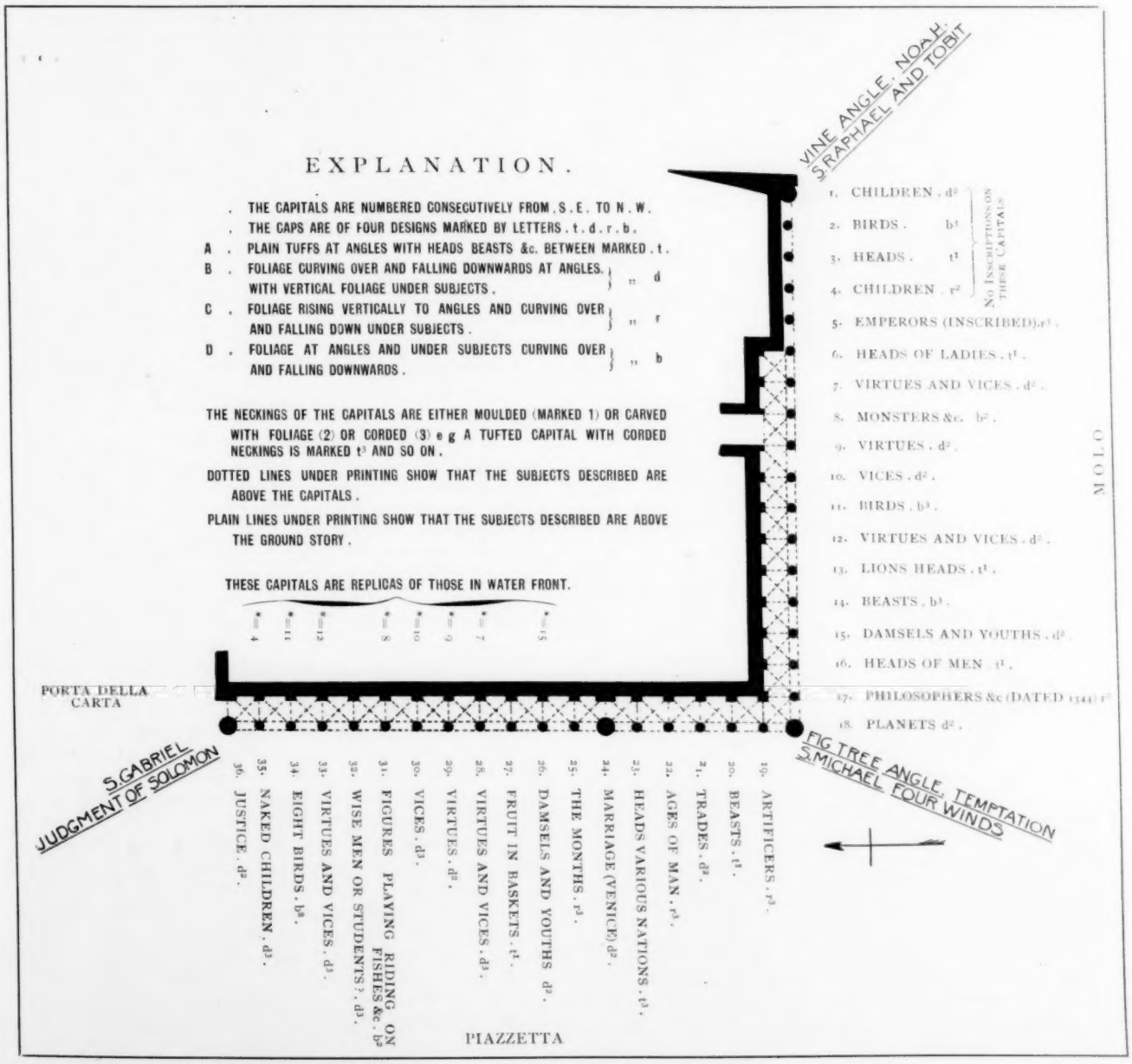
XXXII. Students. This is *not* a replica of No. XVII. The figures are admirably treated, all looking thoughtful, and some holding foliage. It seems to represent the more thoughtful side of youth ascompared with the idle side, represented in the capitals XV. and XXVI. Zanotto supposes the figures to be the seven wise men of Greece; but the eighth figure — a woman speaking — does not lend itself to this. Mr. Burges most ingeniously suggests that it refers to Nouvella d' Andrea, who, in her father's last illness, lectured from behind a curtain to his pupils; her father died in 1348.

XXXIII. Virtues and Vices. This is a replica of No. XII.

XXXIV. Eight birds. A replica of No. XI.

(*Continued on page* 187.)

KEY PLAN OF CAPITALS DUCAL PALACE, VENICE.


EXPLANATION.
. THE CAPITALS ARE NUMBERED CONSECUTIVELY FROM . S . E . TO N . W.
. THE CAPS ARE OF FOUR DESIGNS MARKED BY LETTERS . t . d . r . b .
A . PLAIN TUFFS AT ANGLES WITH HEADS BEASTS &c. BETWEEN MARKED . t .
B . FOLIAGE CURVING OVER AND FALLING DOWNWARDS AT ANGLES. WITH VERTICAL FOLIAGE UNDER SUBJECTS . " d
C . FOLIAGE RISING VERTICALLY TO ANGLES AND CURVING OVER AND FALLING DOWN UNDER SUBJECTS . " r
D . FOLIAGE AT ANGLES AND UNDER SUBJECTS CURVING OVER AND FALLING DOWNWARDS . " b
THE NECKINGS OF THE CAPITALS ARE EITHER MOULDED (MARKED 1) OR CARVED WITH FOLIAGE (2) OR CORDED (3) e g A TUFTED CAPITAL WITH CORDED NECKINGS IS MARKED t3 AND SO ON .
DOTTED LINES UNDER PRINTING SHOW THAT THE SUBJECTS DESCRIBED ARE ABOVE THE CAPITALS .
PLAIN LINES UNDER PRINTING SHOW THAT THE SUBJECTS DESCRIBED ARE ABOVE THE GROUND STORY .
THESE CAPITALS ARE REPLICAS OF THOSE IN WATER FRONT.
*=4 *=11 *=12 *=8 *=10 *=9 *=7 *=15
VINE ANGLE. NOAH. S. RAPHAEL AND TOBIT
No INSCRIPTIONS ON THESE CAPITALS
1. CHILDREN . d2 .
2. BIRDS . b3 .
3. HEADS . t3 .
4. CHILDREN . r2 .
5. EMPERORS (INSCRIBED) . r1 .
6. HEADS OF LADIES . t1 .
7. VIRTUES AND VICES . d2 .
8. MONSTERS &c. b2 .
9. VIRTUES . d2 .
10. VICES . d2 .
11. BIRDS . b3 .
12. VIRTUES AND VICES . d2 .
13. LIONS HEADS . t1 .
14. BEASTS . b3 .
15. DAMSELS AND YOUTHS . d2 .
16. HEADS OF MEN . t2 .
17. PHILOSOPHERS &c (DATED 1344) r2
18. PLANETS d2 .
MOLO
PORTA DELLA CARTA
S. GABRIEL. JUDGMENT OF SOLOMON
FIG TREE ANGLE. TEMPTATION S. MICHAEL. FOUR WINDS
19. ARTIFICERS . r3 .
20. BEASTS . t1 .
21. TRADES . d2 .
22. AGES OF MAN . r3 .
23. HEADS VARIOUS NATIONS . t3 .
24. MARRIAGE (VENICE) d2 .
25. THE MONTHS . r3 .
26. DAMSELS AND YOUTHS d2 .
27. FRUIT IN BASKETS . t1 .
28. VIRTUES AND VICES . d3 .
29. VIRTUES . d2 .
30. VICES . d3 .
31. FIGURES PLAYING RIDING ON FISHES &c . b2
32. WISE MEN OR STUDENTS ? . d3 .
33. VIRTUES AND VICES . d3 .
34. EIGHT BIRDS . b3 .
35. NAKED CHILDREN . d3 .
36. JUSTICE . d2 .
PIAZZETTA

THE ART OF BUILDING
AMONG THE ROMANS.

Translated from the French of AUGUSTE CHOISY by Arthur J. Dillon.

PART II.

CUT STONE MASONRY AND ROMAN FRAMING.

FIRST CHAPTER.

MONOLITHIC LINTELS.

WHEN the Greeks gave to their edifices the heavy proportions which are characteristic of the first periods of their architecture, the short inter-columniation, and especially the great depth of the architraves, guaranteed their stability; in these massive buildings the limits of resistance of the stones were far from being reached, and no artifice seemed necessary to avoid overloading. But when, in the sixth century before our era, the increase in wealth and the desire for refinement led the Greeks to build monuments which were both larger and of lighter proportions, their architects saw with anxiety the chances of rupture multiply, and sought to reduce them. They conceived the idea of setting the stones on the edge of the strata when they were intended for architraves or lintels whose loads seemed excessive. The Romans adopted this ingenious idea, and we will study in their natural order its applications in the two styles of architecture, taking as a first example the great temple of Pæstum.

The stone of which this monument is constructed is travertine with well-marked strata. It can stand great pressure if it is laid on its quarry or natural bed (Fig. 73a); but, used for lintels or for beams supported only at the ends, it can be advantageously employed only under the condition of having its strata vertical, that is, of being set on edge (Fig. 73b).

Profiting by this, the architects of Pæstum set the stones, according to their use, in two different ways, the ones on their natural beds, the others on edge; and all those that were used as lintels were set on edge. The expedient is worth being emphasized, and, not contenting ourselves with indicating it in general terms, it is quite proper for us to verify it by examining one by one the different parts of the edifice (Plate XXIV., Fig. 1). The question is, then, what stones at Pæstum have to resist transverse strains, and how are these stones set.

1st. Of the exterior architrave A there can be no doubt; it should be and it is constructed of stones set on edge, the strata parallel to the vertical faces.

2d. The architrave B, which crowns the upper order of the cella, carried the weight of a roof. The form and extent of this roof is of no importance; entire or partial, it existed; and, directly or by means of some intermediary, it bore on the architrave and tended to deflect it; therefore the stones of the architrave should have been set on edge, and that is what we find to be the case; the section of these stones is an exact square.[1]

Hence, it made no difference, as far as expense was involved, whether the stones were set one way or the other. Would the architects have adopted this unusual way of placing the stones if they had not seen, as a result of it, some increase in strength?

The molded slab C, which is interposed between the architrave and the roof, had to resist crushing only; hence, it is set on its natural bed.

That stones in the exterior frieze are found to be on edge is a detail that carries no conclusion; the frieze was, above all, decorative, and in cutting it the principal object was to obtain the smoothest possible faces, which could best be done by taking the stone in the direction of the grain. This, then, cannot be used as an argument against our theory, so let us pass to the consideration of the stones which form the architrave of the lower order of the cella.

These stones had a tendency to bend under their own weight, and at the same time were compressed between the columns they carried and the columns that carried them. Hence, there were conditions that imposed two contrary courses, but, as the latter stresses were clearly the greater one, the stones should have been laid on their natural beds; and it is thus that they are found.

When the matter is thus put there can be no hesitation in holding that the course followed by the Greeks was entirely correct; yet it may be asked if a third condition did not enter into and make the question more complicated. I have shown the floor at the level of the architrave D, and there can be no doubt that it once existed; but is it so certain that it was carried on special beams, as I have represented it? The boards or slabs of which it was made have disappeared, and it may have been that they rested directly on the architrave. In this case the architrave would have had to resist another transverse strain; and in proportion to its importance the preceding reasoning would still hold good or would be more or less invalidated. Hence, it is only by deciding how the floor was really carried that we can decide how far the use of stone on edge by the architects of the great temple was the result of system.

Happily, there can be no question of its position; the upper architrave is surmounted by a cornice with moldings on both faces, while the lower architrave is ornamented on one face only,— the one

FIG. 73.

toward the interior of the building. From this we must conclude that both faces of the upper architrave were visible, and that the unornamented face of the lower one was concealed; and there was nothing to conceal it, unless it was the floor in the position in which I have shown it in the drawing.

This conclusion is still farther strengthened if the analogies between the temples of Pæstum and of Egina are considered. The two temples are alike in every way,— the same general plan; the same division of the cella into aisles by two-storied colonnades; the same methods of cutting the stone; and at Egina, just as at Pæstum, the architrave of the lower order is profiled on only one face (Plate XXIV., Fig. 5). But at Egina there is an indication of the position of the floor that is missing at Pæstum, for the beams that carried it were let into the architrave and the mortises still remain (same figure, tenons K). Assuredly the position was the same at Pæstum, and the architrave had no cross strain to resist other than that of its weight, and, as there was considerable pressure on its extremities, it was better to place it on its natural bed.

This, shown in the above remarkable instance, was the only expedient adopted by the ancient Greeks to increase the strength or span of their monolithic lintels. The Romans, though acquainted with the system of arched construction, recurred in more than one case to the use of stone on edge; and the perhaps most notable example of their application of it is found in the architecture of a country where Greek traditions had a dominant influence, — Provence.

The amphitheater of Arles has about its entire circumference a two-storied corridor, whose upper story is vaulted by a series of barrel vaults supported on large lintels, with their axes perpendicular

[1] This can be verified by examining the drawings in the work of M. Aures on the dimensions of the great temple of Pæstum. M. Aures was kind enough to allow me to see the work before its publication; and I have scrupulously followed it wherever I had to show details of architecture which had escaped me in a study made with an entirely different object.

to the axis of the gallery (Plate XVII., Fig. 1). This arrangement is justified by the general economy of the edifice, by conveniences of plan into which we need not enter; but, considered as a matter of construction, it had the disadvantage of bringing the weight of the barrel vaults onto lintels which could not be built up of keys without producing unbalanced thrusts against the piers, and which could not be made in a single piece without the risk of rupture. The Romans judged that the second risk was the less, and made the lintels monolithic, but they took care to place them in the position that would make their resistance greatest, — for all the stones AB, CD, are on edge. This, moreover, cannot be attributed to chance or to error; there are a hundred of the lintels in place, and without an exception all are set on edge. A circumstance which still further shows the true reason of placing them on edge is that these lintels, as well as those of Pæstum, were cut from blocks of exactly square section (Fig. 74); the width, including the projection of the moldings, is equal to the height; the stone, as brought from the quarry, had equal faces, so there was no reason, as far as the cutting was concerned, why one face should be given preference to another in carving the moldings; it was the question of strength only that decided this; and in the amphitheater of Arles, as in the temple of Pæstum, the same conditions lead to the same solution.

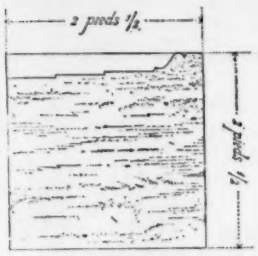


FIG. 74.

It is useless to give other examples after this double verification, which clearly shows the theory which guided the ancients. In profiting by the greater rigidity of stone set on edge, they were able to space their supports more widely; they carried the use of stone lintels as far as possible; in order to obtain greater strength in the lintels, or, to put it the better way, to space the points of support more widely, it was necessary to make a radical change in the system of construction, to abandon the use of monolithic lintels and adopt either the concrete vaults which we have described or the vaults of cut stone which remained to be examined.

(*To be continued.*)

BRICK AND MARBLE IN THE MIDDLE AGES.

(*Continued from page* 185.)

XXXV. Nude children. A replica of No. IV. They have birds, fruit, etc., in their hands.

XXXVI. Justice and Lawgivers. This is the north-west angle column. The capital has the following subjects: (1) Justice; JUSTITIA. (2) Aristotle; ARISTOTEL . CHE . DIE . LEGGE. (3) Moses; - - - L . PUOLO . D . L . SUO . ISEL . RITA .[1] (4) Solon; SAL . UNO . DEI . SETE . SAVI . DI . GRECIA . CHE . DIE . LEGGE. (5) Scipio; ISIPIONE . ACHASTITA . CHE - - - E . LA . FIA . ARE.[2] (6) Numa Pompilius; NUMA POMPILIO . IPERADOR . EDIFICHADOR . DI . TĒPI . E . CHIESE. (7) Moses receiving the tables of the law; QUADO . MOISE . RICEVE . LA . LEGE . I . SUL . MONTE. (8) Trajan; TRAINO . IPERADORE . CHE . DIE . JUSTITIA . A . LA . VEDOVA.

The carving of foliage in this capital is, I think, simpler, and on the whole better than that on the other great angle, capital No. XVIII., with which it invites comparison: but the carving of the figures is quite inferior and later in character. The foliage above this capital, which supports the Judgment of Solomon, is inferior to that on the capital itself, and is, I believe, considerably later in date, being no doubt of the same age as the figures in the Judgment, i. e. not earlier than 1430–1450. Above this angle is the figure of the Archangel Gabriel.

[1] Unintelligible; but explained by Zanotto to be: "Mosè che die' legge al suo popolo Israelita."

[2] Zanotto reads this: "Scipione a castita che rende la figlia al padre."

THE BRICK ARCHITECTURE OF HOLLAND.

BY R. CLIPSTON STURGIS.

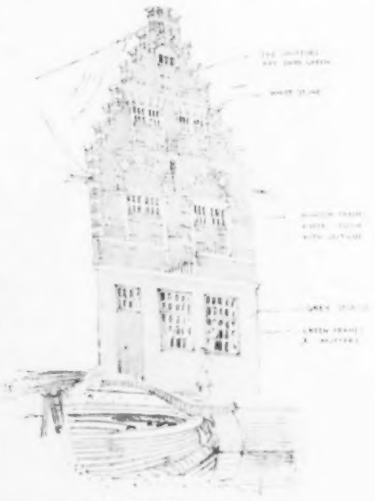
A BRICK WINDMILL, ROTTERDAM.

THE art of a people is so intimately connected with their history and character that it is impossible to form a fair judgment of it without some knowledge of the circumstances and surroundings which have developed that art.

Before we take up the consideration of the architecture of the low countries, it will be worth while to run briefly over the history of the remarkable people who, with no natural resources to aid them, have yet made so great a mark in the history of nations.

Holland as a country is, more than any other in the world, the product of man's ingenuity, industry, and steady perseverance. A more hopelessly unpromising tract of land can hardly be imagined than this, which was little else than the semi-submerged banks of three great rivers which wandered through these low countries and disputed with the sea their possession. Yet this is the country which in Cæsar's day we find peopled by a sturdy, self-reliant race. The Batavians alone of all the northern tribes who came into contact with Rome maintained to a certain degree their independence, and were correspondingly valued by the Romans as allies, and as a nation from whom the most reliable troops could be drawn.

Their country, as I have said, was constantly subject to overflow from the rivers and invasion from the ocean. It was necessary to fortify, as it were, every bit of land in the country, in order to protect it from the turbulent and grasping waters, which were ever ready to find the weak point and rush with ruin over the crops.


A HOUSE AT HOORN.

Such a steady warfare with nature invariably produces a vigorous, self-reliant people, in direct contrast to the people of more favored climates, where crops are produced without exertion. They have so much to contend with, and have so frequently to face disaster, that they are prepared to attain success only through vigorous and unremitting effort. A people who had worked so hard to hold their footing with nature would naturally be disinclined to yield their liberties or rights, and we find them ever an independent, liberty-loving people.

In the days of the Roman power they were, as has been said, practically independent allies; in their later history the Batavian

stock predominated and gave the stamp to a people who are practically the Hollanders of to-day. They were, during the early Middle Ages, a barbarous, but a strong and vigorous people, having the German belief in a single God, rather than sharing in Roman polytheism, and according to woman a much higher position than was usual even among the more civilized nations.

The history of this people is the history of magnificent struggles with nature and with man. The courage they gained in the one mastery gave them strength to stand up against imperial Rome and the Cæsars, and against papal Rome and Spain.

Such were the inhabitants of Holland, an independent, free people, who, under Charlemagne, were made part and parcel of the great German Empire; later, when it was dismembered and parceled out into various dukedoms and small sovereignties, these Dutch people, even in those dreary feudal times, kept a considerable amount of liberty, and had their rights and charters which they would yield to none.

There was, however, little national unity up to the sixteenth century. The city was the unit. The municipalities had the wealth and the power, and they were the important elements. It was municipal freedom which was guaranteed by the various codes, statutes, joyful entrances, etc., which were granted them from time to time.

It is significant to note that the earliest of these charters, 1217, granted merely law and order in place of arbitrary judgment; they were making no extravagant demands, they asked merely for justice. This temperance is noticeable in all their later history. Their great leaders against Spain, voicing the people, claimed no freedom from the righteous rule either of church or state. It was misrule against which they revolted. It was "the revolt of the common sense of the better educated among the masses against the terrible abuses of knowledge and power which had been the growth of centuries" (Motley I., 257).

Gradually the cities began to obtain power in state affairs, and gained the right to send deputies to the parliamentary assembly. We realize the enormous growth which liberty had made when we see how violent was the rebound at its first check, when Philip succeeded to the dukedom in 1437. From now on the history of the Hollanders is like the story of some great contest in the Roman arena, in which the little half-submerged country of Holland is the amphitheater where noble suffering and noble deeds find at last their full reward; and the nations of the world are the spectators, who watch with eager interest this struggle for more than life and death and throw occasionally a word of encouragement to the little handful of heroes fighting against such fearful odds to maintain their liberties.

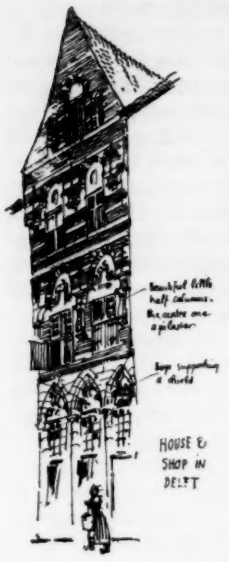
Nor was it only for political freedom that they fought, for from the beginning of the papal claim to supremacy they opposed it and showed a determination to apply the principle of home rule to their religion. This, indeed, led to innumerable vicious sects, but it fostered a spirit of self-reliance which was eminently useful to them in their prolonged struggle. The terrible upheaval of the Reformation came with dreadful force on Holland; nowhere was it welcomed more warmly and nowhere did men suffer more awfully in defense of its principles.

Looking back on those times from this peaceful epoch, one can perhaps see more clearly how truly great and wise were men like Erasmus and Pope Adrian in their endeavors to smooth out the troubles; but it was no time for half-way measures, and the Hollanders, even those, who, like Orange, were at heart faithful Catholics, were committed to yield no jot to the pope. It was the same indomitable spirit of freedom.

During these many and various struggles the masses of the people, the great middle classes, were the mighty factor. They built the cities, dyked their land, traversed the world with their vessels; and when fire and sword or the angry waters destroyed their cities and their dykes, with never-tiring energy they rebuilt them, better, stronger, more beautiful than before. It is a marvel that people so harassed should ever have had time or courage to do more than merely house themselves; yet they did so do, and their monuments of brick and stone are no less enduring than the liberty which they builded so strong and sure.

Politics, religion, art, and literature, all were studied and digested by this versatile people. In the end they acquired full liberty, and sent men imbued with the same liberty-loving spirit to our own country to teach us many a lesson of industry, thrift, and economy, together with the true laws of self-government. As a people they never confounded liberty with lawlessness, but were ever a law-abiding, law-loving people, knowing that only in obedience to law can freedom be found. "Like the actors in our own great national drama, these Netherland patriots were struggling to sustain, not to overthrow; unlike them, they claim no theoretical freedom for humanity, promulgated no doctrine of popular sovereignty." (Motley III., 511.) By the fifteenth century we find Holland a prosperous country, with great wealth and extended commerce, its people well educated and thoughtful, banded together in guilds for mutual protection in their work, and in societies for literary and social purposes — freedom the keynote of their every-day lives. At such a time and to such a people came the fearful struggles with Spain already referred to, and by these struggles such men as William of Orange were developed.

A study of his life and character would be of great value as showing typically what was the best outcome and product of the history of the country, but I cannot take space for this. Suffice it to say that he was eminently moderate and just in all things, not easily



aroused, but indomitable in spirit, of a courage which nothing could daunt, neither adversity nor calamity, neither the assault of enemies nor the falseness of friends.

The architecture of a people is a pretty true exponent of their character, and from such a people as we have seen the Dutch to be we may reasonably expect to learn some lesson. I propose to take up three classes of buildings,— *first*, the private house; *second*, the public buildings; *third*, the churches. I take the houses first, because with a law-abiding people the family is the first unit which suggests and forms the municipality and state and both are welded and riveted together by religion.

We may reasonably expect to find the houses of these people to be homes in the true sense, for we have seen them to be a virtuous and sober people, such as make homes and love them. They are, in fact, a homely people. De Amicis, an Italian, writing of modern Holland, was so impressed with the homelikeness of their houses — such a contrast to Italian palaces — that he says, "The true house and home is in Holland. The personal house . . . modest, discreet . . . everything breathes peace and gentleness, and the neighboring steeple announces the hour with a flood of harmony sweet and constant as his affection and his labor." Could he have said this of our stained shingle affairs, which form the suburbs of our cities, and which, save the mark, are the "homes" of a large proportion of our people? Porbably not, any more than he could have called the bells melodious which clang harshly from our steeples.

Even in the dingiest parts of the cities De Amicis found this touch of home life, — "pots of flowers, neat muslin curtains, revealing a poverty not unaccompanied by a love of home and family." I have seen the same myself, and nowhere else have I seen it except in England. It concerns us to inquire what produces this effect, as it is certainly a desirable result to obtain. First and foremost, I think this is due to the fact that the Dutchman builds in permanent materials, showing that his home is to him a lasting possession. I think, too, it is due to a certain honesty of purpose and simpleness of execution, with a plain adaptation of means to an end, accompanied by a sense of the privacy of the home and an humble spirit which makes self-assertion impossible. So when he builds his home it is simple and quiet, unostentatious and honest.

Brick is about the only building material which Holland can produce — there is practically no stone — so the material is brick. Now, when a people like the Dutch undertake to do a thing they do it thoroughly well, and there are no better or more beautiful brick made than those which come from the kilns of Holland. They are perfectly true, with beautiful surface and texture, and in proper proportion. They vary in hardness from the klinkers with which they pave their roads to the soft brick which, though strong and fairly durable, can be sawn, cut, and rubbed; and in color, from black and green to the most brilliant of reds.

When it comes to building, if the owner is a shopkeeper and has his shop in his house, the lower story frankly acknowledges its purpose (but is not on that account iron and plate glass), while his upper stories, gay in summer with flowers, and curtained with spotless muslin, show at once that women and children are there. If it is his dwelling-place only, it is modest, dignified, and unpretentious on the outside; no ostentation, and only such ornament as may serve to indicate its owner's occupation or rank, or give a touch of interest to the façade and make it gay, or a carven verse to show its owner's God-fearing pride in his home and family. If the owner is wealthy, the chances are his house will be hardly distinguished from his less favored neighbor's, except, perhaps, in size. He will tend rather to put his money into beautiful things for the inside of his house, for the pleasure of his family and his friends, than to place ornament on the outside and call undue attention to himself from the general public.

That the Dutch are not selfish in keeping to themselves their treasures, and depriving the poor man of the opportunity to enjoy them,— the argument that is so often brought forward to excuse a vulgar display of wealth on our houses and grounds,— is sufficiently proved by the wealth of their museums.

As I have said, these homelike houses are not barren of ornament outside. There are bits of carving — always in good scale and well placed, by the way,— picturesque gables and dormers, making good skylines and plenty of color. The warm red brick and white stone (often kept gay with paint — a questionable expedient, unless one considers the smoke-blackened alternative), the brick full of all that variety of color which the kilns give us, emphasized by the

regular bond, or a diaper pattern, and laid with great nicety, contrasted with gay green and white shutters and doors; polished brass gleaming in the sun, flowers in the windows, and potted trees at the doorstep.

Did you ever notice a little touch of art which shows itself in the way they lay their brick bond as differing from the English? Both use most generally the so-called English bond,— continuous rows, first of stretchers, then of headers. The English lay these rows all alike, but the Dutch break joint with the stretcher rows, thus keeping the same structural strength, but varying the lines of the vertical joints and giving regular diagonal lines which are very pleasing. It adds just that touch of art which we find all through Dutch work when compared with English of a similar period. Where Tudor work is coarse (picturesque and strong, it is true), the Dutch is refined and executed with the skill of an artist, and even where the Dutch run into vagaries, they are such as artists use, and one can well pardon a little frivolity in art to a people who have had so much stern reality in their daily lives.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

ALMOST important series of tests, to determine the practical value of the various systems of fire-proofing, is soon to be made, under the direction of the Architectural League of New York, the American Society of Mechanical Engineers, and the fire insurance companies of New York.

The committee under whose direction the tests will be made consists of Mr. S. A. Reed, representing the Tariff Association of New York; Mr. Geo. L. Heins, the Architectural League of New York; and Messrs. H. de B. Parsons and Thos. F. Rowland, Jr., the American Society of Mechanical Engineers.

It is proposed to conduct these tests on a scale never before attempted, and one of the principal things to be determined is the effect of intense heat on structural iron and steel when protected by the different fire-proofing materials.

The committee will keep an accurate record of all data connected with these tests, which will be published in their report.

The committee has organized, and has commenced to build the required plant. There will be a gas-producer, to supply the fuel gas, so arranged to receive a spray of petroleum in case higher temperatures may be required than those obtained from the combustion of the gas alone.

Furnaces for testing full-sized columns and floors will be erected. The foundations of these furnaces will consist of side walls with an arch between them, thus making a safe place for the introduction of the gas pipes and for the hydraulic cylinder. On the top of this foundation will be erected a room built of the materials to be tested. The columns will be loaded by pressure from the hydraulic cylinder, and during the tests a safe load, such as is prescribed by the building laws of this city, will be put upon it. The arches for the floors will be loaded by dead weight. Every precaution will be taken by the committee to make the tests uniform as regards temperature, draught, cooling by water streams, etc., so that the results may be comparable.

A SERIES OF FIRE-PROOFING TESTS.

THE *American Architect* of September 7 contains a very interesting account of a series of fire-proofing tests instituted by Mr. Willard T. Sears, of Boston, and conducted under the direction of Mr. F. E. Cabot, Superintendent of the Boston Board of Underwriters. The report says:—

During the early spring of 1895 a number of test-houses were erected in the basement and first story of a new fire-proof building in process of erection on Boylston Street, in the city of Boston, for the purpose of making a comparison of the value of different materials for fire resistance only.

The tests were instituted by Mr. Sears for the purpose of obtaining accurate data in determining the value of several different systems of fire-resisting construction presented to him for adoption in buildings that he was designing for various uses, viz.: An appraiser's warehouse, 70 ft. by 150 ft., seven stories high, to be occupied by the United States Government; a warehouse 60 ft. by 200 ft., six stories high, for mercantile purposes; a store and office building, 50 ft. by 125 ft., six stories high; an apartment house 106 ft. by 90 ft., eight stories high.

It will be observed that the character of these buildings admitted of a considerable variation in the strength of construction to be used, and the object of the investigation was not only to obtain the lightest construction suitable to meet the requirements for strength and stability, but also to determine fire-resisting qualities that would allow everything of a combustible nature in any room or portion of a building in which a fire might occur to burn out without the fire extending to other portions of the building.

The result of these tests has demonstrated the fact that, where proper care is taken to fill all air spaces and holes in the different stories, especially where the floors join walls and partitions, and where pipes and wires pass through them, a building is practically safe from fire extending beyond the room in which it was ignited, and, in an office building, apartment house, and buildings of like character, if the fire were to be allowed to burn out the contents of the room without water being thrown upon the fire, less damage would probably result than if water were thrown upon the hot plastered concrete, which might crack and become loosened from the metal lathing, and cause damage in adjoining rooms.

One side of each of these houses was built against one of the party walls of the building, which was given a coat of King's Windsor dry mortar, to prevent the fires from scaling the brickwork. The other three walls, floor, and roof were constructed of the material to be tested.

For future reference, these test-houses were numbered 1, 2, 3, 4, 5, 6, 7. Numbers 1, 2, 3, 4, and 5 measured 4 ft. 6 ins. by 8 ft. 6 ins., and were 8 ft. high; these were located in the basement.

An opening 2 ft. by 3 ft. was left at one end of each to admit fuel, and at the opposite end a connection with each was made to 8 in. by 12 in. flues of the building to carry off the smoke.

The roofs of these houses were built between and supported by the first floor beams of the building, and were virtually floors.

The two houses erected on the first or ground floor were numbered 6 and 7, and were each 4 ft. 6 ins. by 8 ft. 6 ins. They were 11 ft. high, and were built of wood.

As in the basement houses, each was provided with an opening at one end, 2 ft. by 3 ft., for the admission of fuel, and was connected by 8 in. by 12 in. smoke flues of the building.

These houses differed in their construction as follows:—

No. 1.—Erected by the New Jersey Wire Cloth Company, according to the Robeling system of construction. Steel studs, 2½ ins. by $\frac{3}{16}$ in., placed 16 ins. on centers, were fastened securely to the basement floor and to the ceiling; these were covered on both sides with stiffened wire lath of their manufacture, and the house was then plastered within and without with two coats of King's Windsor dry mortar.

The roof was constructed of stiffened wire lath, sprung between the first floor beams in the form of an arch, which was covered with a concrete of broken stone, sand, and cement. This was leveled off flush with the tops of the floor beams, giving practically a concrete arch of the depth of the beams (12 ins.) at the springing, and 4 ins. deep at the crown; wire lath was also carried beneath the lower flanges of the floor beams, and the whole ceiling below was plastered with two coats of King's Windsor dry mortar.

No. 2.—The walls of this house were built by the Eastern Expanded Metal Company: Strips of wood, 2 ins. by ½ in., placed 16 ins. on centers, with ordinary stove-pipe iron applied to the 2 in. faces, secured at floor and ceiling (the office of the wood strips being to furnish a simple means of securing the metal lath, ordinary iron staples being used). They were then covered inside and outside with expanded metal lathing, and plastered within and without with two coats of King's Windsor dry mortar.

The roof of this house was built by the New Jersey Steel and Iron Company, and is known as the "Metropolitan Floor." Cables of twisted galvanized iron wires were stretched between the roof beams and fastened to the top flanges by means of a hook of No. 12 copper wire. These cables passed under ¾ in. round iron rods, placed between the beams midway of the span, which gave them a belly-truss form, and kept them taut while the plaster concrete was being applied.

Flat level forms of wood were placed beneath these cables (about 3 ins. below the top flanges). The lower portions of the webs and bottom flanges of the beams were covered with wire netting, so as to form ceiling beams when finished.

Upon and around these forms a composition of plaster of Paris and wood chips was poured, and leveled off 1 in. above the top of the beams. The constructional iron was thus entirely covered with not less than 1 in. of the composition. When it became thoroughly set the wood forms were removed. The ceiling was left unplastered below.

No. 3. — This house was built throughout by the Eastern Expanded Metal Company. The walls were of steel channel bars, studs ⅜ in. by ¾ in., placed 12 ins. apart, secured at floor and ceiling, and covered with expanded metal lathing, and were plastered within and without with two coats of King's Windsor dry mortar, embedding both studding and lath in a solid body of plaster.

The roof was built in two sections: The whole area was first covered with expanded metal, sprung between the beams in the form of an arch. This was covered with a concrete of cinders, gravel, and cement, leveled off 2 ins. above the floor beams, giving a concrete arch about 5 ins. deep at the crown. One section was plastered directly upon the under side of the arch. In the other section ⅜ in. by ¾ in. steel channel bars were secured to the lower flanges of the roof beams and covered below with expanded metal. This was then plastered, giving a flat ceiling.

No. 4. — The walls of this house were built by the Clinton Wire Cloth Company: Studding of ⅜ in. by ¾ in. steel bars, placed 16 ins. apart, secured to the beam flanges, and covered on the outside with Clinton wire cloth of ½ in. mesh. The two end walls were additionally covered on the inside with wire cloth, and the building was plastered throughout with two coats of King's Windsor dry mortar.

The roof of this house was what is known as the "Eureka floor," constructed as follows: —

Wood centers of 2 in. plank were placed 2 ft. on centers between the roof beams, resting upon the lower flanges.

The tops of these centers were level and flush with the tops of beams; the under side was cut in the form of an arch, leaving 3 ins. of wood at the crown. The under side edges of the wood centers were beveled off to ¾ in. thickness, and Clinton wire cloth stapled to them. A concrete of gravel, sand, and cement was filled in and leveled off flush with the tops of the floor beams and centers.

These centers gave nailings for the wood floor above. The ceiling below was plastered with two coats of King's Windsor dry mortar.

No. 5. — Was built by the David McIntosh Company, of hollow, porous terra-cotta blocks 3 ins. thick, laid up in common mortar and plastered on both sides with two coats of King's Windsor dry mortar.

The roof was built of 12 in. hollow, porous terra-cotta floor-blocks, plastered below and covered on top with 2 ins. concrete, in which were embedded 2 in. by 4 in. beveled strips to form nailings for wood floors.

No. 6. — The floor was of wood joists 2 ins. by 12 ins., set 16 ins. on centers, upon which was placed first a rough floor of ⅞ in. matched pine floor boards, 6 ins. wide, then two thicknesses of building-paper, and last a finished maple floor ⅞ in. thick.

These floor-joists were lathed and plastered on the under side to represent a ceiling of a lower room. Upon this floor were erected walls or partitions of 2 in. by 4 in. studs, placed 16 ins. on centers, lathed with wood laths and plastered in the usual way, King's Windsor dry mortar being used. The roof was constructed in the same manner as the floor.

No. 7. — A floor of 3 in. pine plank splined together was laid directly upon steel I-beams 5 ft. apart; upon this was laid a double thickness of building-paper, and then a ⅞ in. finished floor of maple.

Upon this floor were erected walls or partitions of 3 in. pine plank splined together and covered on both sides with stiffened wire lath lapped 2 ins. at each joint. The roof was built of 3 in. pine plank splined together and covered on the under side with stiffened wire lath. The whole building was then plastered with two coats of King's Windsor dry mortar.

On the day appointed for the testing a careful examination of the houses was made before the fires were started.

No. 1, which had been plastered early in the spring, was found to be in bad condition, due, no doubt, to the freezing of the plaster. Its representative objected to the fire-test being made, and it was therefore abandoned.

The walls of Nos. 2 and 3, which had stood directly beneath a light-shaft open to the weather, were found to be slightly damp, but otherwise all the houses were in good condition.

At 10 A. M. small fires were started in Nos. 2, 3, 4, and 5 for the purpose of starting draught. At 10.30 cord-wood was thrown upon all the fires, care being taken to distribute the fuel so that the flames should reach every part of the interior of the houses.

At 10.45 A. M. hot fires were burning in Nos. 3, 4, and 5, and by 11 in No. 2, also. The fires were kept at a great heat and at a maximum intensity in each house for one hour, after which time fresh fuel was not added. No water was thrown upon the fires directly, or upon the houses.

Careful notes were taken of any change in the condition of the house during the firing, and after the fires had gone out a careful inspection was again made.

These notes were taken and have been arranged in the form of a comparative table by Mr. H. W. Chamberlain, of Massachusetts Institute of Technology, as follows: —

Test No.	Fire started.	Fire under good headway.	Action during test.	Condition at end of one hour.
2.	10.30 A. M.	11 A. M.	At 11.10 A. M. plaster dropped from brick party wall.	Plaster on expanded metal intact. Brick party wall scaled in a few places from action of fire.
3.	10.30 A. M.	10.45 A. M.	10.45 A. M. There was an explosion. It threw the plaster off expanded metal wall on inside near lower front corner, and from the brick party wall. At 11 A. M. there was a second explosion, which threw the plaster from inside and outside of expanded metal wall near lower front corner, leaving a hole about 2 ins. in diameter. A third explosion threw plaster from inside of expanded metal wall near the bottom.	Ceiling intact. Except on brick party wall the plaster that was thrown off was the second coat. The metal was exposed where the explosion made a hole in the metal wall. The bricks scaled off the party wall after the mortar came off.
4.	10.30 A. M.	10.45 A. M.	10.50 A. M. Plaster dropped from brick party wall.	Ceiling intact. Bricks on party wall badly scaled by action of fire.
5	10.30 A. M.	10.40 A. M.	10.50 A. M. Explosion. Plaster dropped from brick party wall and part of the ceiling.	Brick party wall badly scaled; tile ceiling sustained no injury. Plaster on side wall cracked, but still clung to the wall.

During the fire the outside of the buildings in no case became too hot to bear the hand. The sides and ends of No. 2 and the side of No. 3 were hottest, as would be expected from the construction.

The top flanges of the floor beams above houses Nos. 2 and 5 were cool all through the test. Those above No. 4 were warm, while those above No. 3 were fairly hot. On breaking open the sides of No. 2, it was found that the wood strips in the studding had been charred by the action of the fire to a depth varying from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. deep, according to position in the walls. The tops of some of the studs were charred more than half way through. The floor centers of No. 4, on the other hand, were scarcely charred at all; in no case more than $\frac{1}{16}$ in. deep, and in nearly all cases the wood had not been discolored.

The difference in expansion between the ironwork and the plaster seems to have been inappreciable, as in all cases the plaster adhered closely to the metal.

The explosions referred to may have been occasioned by gases formed by the great heat or by dampness in the materials.

The action of the fire on test-house No. 6 was watched with considerable interest; it had been decided to let the fire burn here until it made its appearance on the outside. The fire was started at

11.45 A. M. The plaster dropped from the brick party wall at 12 M. and from the laths on the rear end near the bottom at 12.05. The laths and studs were well on fire in the rear at 12.10 P. M., and at 12.20 plaster dropped from the ceiling and the wooden side walls. At 12.25 the whole building was thoroughly on fire within; the outside plastering was still intact, although too hot to bear the hand. Later, a crack began to open along the angle at the junction of the end and side walls, which increased steadily until 12.50 P. M. (an hour and five minutes from the time of starting the fire), when flames made their appearance through the crack, and water was immediately applied and the fire extinguished.

On breaking away the exterior plaster on the rear wall of the house, it was found that the laths behind it were all burned away to a height of 6 ft. above the floor.

The studs were also badly burned. The sidewalks were in a similar condition.

The brick party wall was badly scaled over its entire area.

The top floor had been burned away in front near the firing-door, but the under floor was still sound; half way back, the top floor had not been burned through.

In No. 7 the fire was started at 12.27 P. M., and was well under way by 12.50. The plaster dropped from the brick party wall at 12.55, but the plaster on the metal lathing was intact, but red-hot.

At 1.25 P. M. two cracks appeared on the exterior of side wall, where the metal lath was lapped, but neither flames nor smoke had found its way through the house at 2.37 (two hours and ten minutes from the time of starting the fire). It was not thought expedient to carry the test farther, and several attempts were made to extinguish the fire in the walls by throwing water into the houses from hydrant; but, owing to no attempt being made to remove the plaster from the party walls and roof (which remained intact, except the cracks referred to), the planks continued to smolder, protected by the plaster, for forty-eight hours longer, in spite of frequent applications of water upon the plaster.

When the building was torn down, it was found that the planks forming the sides were more than half consumed. The plaster, aside from the drenching it had received, was in good condition.

The top floor had been burned away about half way back from the firing-door, the under plank floor remaining still sound.

The brick party wall was badly scaled over its entire area, showing the intensity of the heat.

A question in regard to the comparative weights of the concrete materials used in the construction of the different roofs having been raised, it was decided to weigh a section of each.

The *débris* from the fires was removed from the houses, the roofs broken down, care being taken to preserve all the material that had entered into their construction, and it was then weighed on platform scales. The data thus gathered are tabulated below: —

Test No.	Construction.	Area of section.	Total Weight.	Weight per sq. ft.
1.	Roebeling System.	18 sq. ft.	1,295 lbs.	72 lbs.
2.	Metropolitan System.	18 „	427 „	23.7 „
3.	Expanded Metal Co.'s System.	22.5 „	1,697 „	75.4 „
3a	Same as No. 3, with additional flat ceiling.	22.5 „	1,814 „	80.6 „
4.	Eureka System.	20.25 „	1,648 „	81.3 „
5.	Porous hollow tile arch blocks covered with concrete 2 ins. thick.	20.25 „	1,781 „	87.95 „

In considering this table it should be noted that all of the floors were plastered on the under side, and were concreted on top, ready to receive the wood floors. The plastering on No. 5 fell during the fire-test and was removed with the *débris*, and, consequently, not weighed with the other material; the weight of the 12 in. floor-beams is not included in the weight given above.

BRICKS AS A PROTECTION TO IRONWORK.

THERE are so many buildings in London and other large cities which depend for their stability upon a metal framework that experiments carried out with a view to ascertain the effects of a fire upon the iron or steel work of which they are composed cannot fail to be of very great interest to all who are responsible for structures of this character. Experiments were made a short time ago at Vienna, under the supervision of the city surveyor, with the object of testing the efficiency of various building materials against fire, and also to ascertain what protection they were capable of affording to ironwork. To make these tests, a brick chamber some 12 ft. by 8 ft. in plan and 11½ ft. high was built, and in the center an iron column was constructed consisting of two channel-bars, 5½ ins. by 2¾ ins. These channels were placed 2½ ins. apart, back to back, and were braced together with light lattice-bars. Within the space between the channel test-bars, composed of various alloys melting at temperatures between 150 degs. Fahr. and 1.650 degs. Fahr., were placed, the column afterwards being surrounded with brickwork in mortar, thus forming a pier some 18 ins. square. In order that the test should as nearly as possible resemble the conditions met with in actual practise, the column was loaded with a sufficient weight to cause a stress of 3¼ tons per square inch on the ironwork. Fuel was then strewed over the floor of the chamber to a depth of some 3 ft., and the firing was fully maintained for the space of 2½ hours, and was subsequently extinguished by the fire brigade. The heat had, however, been so great that it was not until the next day that a thorough examination of its effect could be made, but it was then discovered that, although the edges of the brickwork pier were crumbled to an extent of 1½ ins., the iron column was quite uninjured, and only the test-bar, capable of fusing at 150 degs. Fahr., showed any indication of melting. It would thus appear that the brickwork was of ample thickness to protect the ironwork, and that when such construction is adopted in actual practise a building is probably as fire-proof as it is possible to make it. — *British Clay-Worker.*

THE *Canadian Architect and Builder*, which has made a most thorough investigation of the causes which led to the complete destruction by fire of the Simpson Building, Toronto, which was considered to be fire-proof, has this to say: The plastering throughout the building was of Acme cement, the columns being also plastered with it on metal lath. This protection would have successfully resisted an ordinary fire in the new building, but was powerless, of course, to resist the intense heat developed in the old adjoining buildings, which were directly connected with the new, without the interposition of any wall.

It has been said of the Simpson Building that the steel columns, which extended from the ground line to the top of the second story, were inadequate to carry the weight of the building, and that the large masonry columns were partly used to give strength to the steel work.

We have made careful inquiry on this point, as it is one of importance, particularly from a structural point of view. Our information shows that the outer walls were carried from the third story entirely on the steel columns, which extended from the ground lines to the top of the second story. These columns were encased afterwards with brick and terra-cotta. The protection of these columns and the beams which they carried was so thorough that paper signs which had been pasted on them were intact when the brickwork was taken down. The stone and terra-cotta of the two lower stories in no way supported the building, and were only a casing or ornamental and protective feature.

Had it been intended to make the building fire-proof, the iron beams, which became so terribly twisted, would have been encased in fire-proof material, such as porous terra-cotta. But this was not done. Profiting by the experience of the late fire, we are glad to learn that the new building will almost certainly be made fire-proof.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI.

THE CHEMISTRY OF CEMENTS.

THE question has often arisen and has been discussed with a greater or less degree of intelligence by writers during the past half century concerning the effects of the presence of magnesia in a cement.

The opinions are so various and contradictory as to lead to the suspicion that very little is known about the subject,—a conclusion difficult to disprove if investigation be confined to the purely hypothetical theories advanced.

It may be stated, however, that at the present time the prevailing opinion is that, while magnesia may not be harmful in a natural cement, even though present to the extent of 20 per cent. of the total, yet more than 3 per cent. of the same material is dangerous in an artificial cement.

This is the position taken by many leading authorities on the subject. Others, however, qualify this statement, or, failing to determine the question, leave the subject in doubt and obscurity. While still others maintain that magnesia is a valuable ingredient in a cement.

Prof. E. J. De Smedt, in his annual report to the Engineer Department, Washington, D. C., ending June 30, 1885, states in regard to the composition of a Portland cement: —

"Portland cement is composed of bi-basic silicate of lime and aluminate of lime; sometimes it contains small quantities of magnesia as silicate or aluminate, some oxide of iron, alkali in small quantity, etc. Silicates and aluminates of lime are the principal constituents of Portland cement, the formulas of which to calculate with are as follows: —

$^2CaO.\ SiO^2$ — Lime	65.12
Silicic Acid	34.88
	100.00
$^2MGO.\ SiO^2$ — Magnesia	57.15
Silicic Acid	42.85
	100.00
$CaO.\ Al_2O^3$ — Lime	67.33
Alumina	32.67
	100.00

"The magnesia may be calculated as lime when found in small quantities.

"A limestone, such as dolomite, containing 46 per cent. of magnesia, has been pronounced unfit for making good cement, but when the percentage of magnesia is not too large it becomes in time just as hard as a cement containing no magnesia, with this difference, that it is somewhat slow in setting. In sea water containing magnesia such cement should be preferred, for the reason that it does not disintegrate in that water.

"After careful analyses, calculations, and comparative tests, I have found that the best results are obtained when the relative quantity of alumina is in the proportion of between one third and one fourth to the total amount of alumina and silica found by analysis. The quality of Portland cement is perfect in proportion as the above formulas are closely adhered to in its composition. Sulphuric acid in more than 1 per cent. is detrimental, and a small percentage of alkali, such as soda or potash, adds very much to the virtue of the cement.

"Now, it is not sufficient that the proportions should be correct; it is also necessary that calcination should be at the proper degree of heat and length of time, in order to produce the formation of bi-basic silicate of lime and aluminate of lime."

Prof. S. B. Newberry, a leading authority on Portland cement in this country, in a paper prepared for the United States Geological Survey and published in Mineral Resources of the United States for 1892, states: —

"Late experiments by Erdmenger and others seem to prove that magnesia is an inert material in cement mixtures, and that this constituent does not combine with silica and alumina after the manner of lime. The injurious effect of magnesia in Portland cement is ascribed to the very slow hydration and expansion of the free magnesia contained in the cement, causing cracking of the mass weeks or months after immersion in water. Magnesium carbonate calcined at low heat combines readily with water; that which has been heated to the temperature of the Portland cement kiln becomes hydrated only after the lapse of long periods of time. The harmlessness of magnesia in common hydraulic cement is doubtless due to the readiness and completeness with which it becomes hydrated on mixing the cement with water.

Prof. E. T. Cox, in his Geological Report for the State of Indiana, 1878, page 70, says: —

"For hydraulic purposes the essential constituents of a cement stone are carbonate of lime and silica. By calcination the carbonate of lime converts the silica into silicic acid, which forms a gelatinous mass with acids. Carbonate of magnesia acts in a similar manner to carbonate of lime, and when the two are present in the proper proportions hydraulic energy is uninterrupted, and a stone is formed, of great strength and durability, which consists of a double silicate of lime and magnesia. A portion of alumina is not objectionable in a cement stone in the presence of plenty of carbonate of lime and silica; it enters into combination as a hydrated silicate of lime and alumina. Sulphuric acid, or sulphate of lime, does not promote hardening or setting of the cement, and the same may be said of the oxide of iron. Large quantities of these substances are therefore objectionable, and they may be looked upon as adulterations.

"Since carbonates of lime or magnesia, aided by alkalies, when present, are the active agents during the calcining of the cement stone in bringing about the decomposition of the silicates and forming a silicate that is soluble in acids, it will be interesting to present a tabular arrangement of the ratio of silica to the carbonates of lime and magnesia in the above, and some additional analyses of cement stones that are in common use: —

ANALYSIS.

	Silicates.	Carbonates.
Balcony Falls, Va.	100	149
Rosendale, N. Y.	100	248
Wabash County, Ind.	100	124
Cumberland, Md.	100	186
Beache's, Clark County, Ind.	100	262
Vassy, France	100	465
English	100	341
Bologne	100	311

"Between the silicates and carbonates, including the carbonates of lime, magnesia, and alkalies, when present, there is a wide variation in cement stones of good repute for hydraulic energy.

"It has already been stated that for hydraulic properties the essential constituents of a cement are silicic acid and caustic lime. The hardening under water is mainly due to the chemical combination of these two constituents *through the agency of water*, producing hydrated silicate of lime; where other bases are present, such as alumina and magnesia, double silicates are formed that become very hard and strong. In order to bring about this chemical change the

silica must be brought to that condition which will enable it to form a gelatinous paste with acids. A portion of the silica may be in this condition naturally, but by far the larger portion remains unacted upon by acids until brought to a white heat in the presence of carbonate of lime."

Many years ago, M. Vicat, the famous French engineer, made the following statement: —

"Magnesia is a valuable ingredient in mortars to be immersed in sea water, and if it could be obtained at a cost that would permit of its application to such purposes the problem of making beton (concrete) unalterable by sea water would be solved.

"Without clay, that is to say, without silica, limes cannot be decidedly hydraulic.

"The different combinations I have tried, by mixing chalk and magnesia, have only produced limes susceptible of setting in the commencement, without any ulterior progress; but this solidification, imperfect though it be, denotes in the magnesia certain hydraulic properties which the alumina itself does not possess.

"If, then, some portions of clay be present, it might happen that a triple hydrate of lime, of alumina, and of magnesia might be formed which should possess all the conditions of hardness and of progression which characterize the best hydraulic limes.

"Two species of limestones which were found to contain respectively, before burning, as follows, viz.: —

Clay	4.00 and 5.50
Carbonate of lime	42.50 „ 52.00
„ „ magnesia	53.50 „ 42.50

yielded limes possessing the hydraulic character in an eminent degree."

M. Parandier stated that "a stone composed of 58 parts of carbonate of lime, 11 of clay, and 31 of carbonate of magnesia yields a very excellent hydraulic lime."

M. Dumas states that "if more than 10 per cent. of magnesia be present, hydraulic limes begin to become poor, and with 25 per cent. they become decidedly poor."

M. Berthier gives the analysis of a hydraulic lime obtained from a mixture of the stone of Villefranche, near Paris, with dissolved silica, in the proportions of 5 of the stone to 1 of the silica.

The analysis of the stone being: —

Carbonate of lime	60.90
„ „ magnesia	30.10
„ „ iron	3.00
„ „ manganese	6.00
Total	100.00

and the hydraulic lime thus obtained became much harder under water than any even of the natural hydraulic limes.

This mixture after calcination would exhibit by analysis the following: —

Silica	25.83
Lime	44.04
Magnesia	18.50
Oxide of iron	3.88
„ „ manganese	7.75
Total	100.00

And, as it contains the ingredients in proportions essential to a good hydraulic cement, it is not surprising that it became "harder under water than any even of the natural hydraulic limes."

Again, "when the magnesian limestones found nearer Paris are mixed with one fifth of their bulk of soluble siliceous matter they yield a lime still more energetic in its hydraulic properties than that above described, although the carbonate of magnesia is present in the proportion of 23 per cent."

(*To be continued.*)

VARIOUS SYSTEMS OF CONCRETE CONSTRUCTION.

CONTINUED FROM JULY NUMBER.

CONCRETE AND TWISTED STEEL.

WOODEN FLOOR TOPS.

BY ROSS F. TUCKER.

IT is often a matter of necessity in some classes of buildings, — offices, hospitals, dwellings, etc., — to have a wooden floor over the concrete.

The common method is to build the concrete floors and then to lay 2 in. beveled nailing strips upon this and fill in with common cement. Such a floor, while good enough for many purposes, has, after all, all the objections common to such a construction, — for instance, the loosening of the floor, due to the shrinkage of the wooden nailing strips, the chance for vermin and consequently for fire, the danger of dry rot, and the vibration, noise, splintering, dust, and general wear of the wood, which is particularly rapid in springy or loose floors.

A good precaution to take against shrinkage of the wood strips is to dip them in tar, pitch, or some elastic composition, which, while protecting the wood, will give a splendid bond for the concrete.

The strips should be large and at least 1½ ins. deep, so as to give a good hold for the concrete, which is usually not of very excellent quality.

But the best of all floors of this kind is one in which the separate strips of wood are cemented or glued so rigidly to the solid bed of the concrete as to hold them absolutely tight and rigid, so that there can be no vibration at all.

One day last winter the writer was crossing the common, and in the lower part of it a plank walk had been laid. The water had risen and overflowed the planks at a number of places, and they had become imbedded absolutely rigid in the ice. It was astonishing to walk upon those boards and note the softness of the walk — as soft and easy to walk upon, in fact, as the finest of moquette carpets. The planks were so held that there was not the least vibration, and the noise was almost wholly done away with. The same thing is observable in walking upon the stump of a great tree or any stick of timber of such dimensions as to be free from vibration.

The principle has been adopted quite extensively in Europe, and recently in this country, in the laying of wooden floors.

One method is to construct a concrete floor under any of the various systems. Bring the surface to an even and level grade, and before the top has set groove it out so as to form a series of dovetailed grooves or slots.

The floor top consists of strips of hard pine, oak, or any suitable wood, from 8 to 12 ins. long, and 2 ins. wide, and 1½ or 2 ins. thick. These strips are also grooved on the under side similarly to the concrete.

On the concrete floor is then spread a layer of elastic cement, which is poured into the grooves of the cement, and into which the wooden strips are pounded until the grooves in the wood are also filled.

The cement hardens, and the strips are held tight and fast to the solid cement, precisely as the planks were in the ice, only with a better bond. The top of the floor is then finished and rubbed down to a smooth surface.

It is said that such a floor will outlast several mosaic or marble tops, and where a soft floor is essential, as in hospitals, asylums, and the like, there is none that can compare with it for ease and comfort. A great many are used in England in the post-offices, schools, colleges, banks, churches, hotels, and public buildings, and it is being used extensively, the writer is told, in the St. Luke's Hospital in New York and elsewhere.

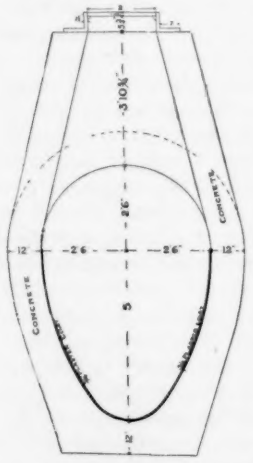
In the next article will appear some cuts of this method of floor work, as well as for forming flat ceilings, as described heretofore.

PORTLAND CEMENT CONCRETE.

THE use of Portland cement concrete has become so general in the erection of large buildings that it is probably familiar to all. In many large buildings recently erected this concrete has been used exclusively in the foundations, in place of brick or rubble masonry, with a great saving in money, time of construction, and durability of the work; but the greater field for the use of Portland cement concrete, viz., culverts, sewers, and small buildings suitable for manufacturing purposes, has been generally neglected. With possibly the exception of Ransome and a few others, nothing much has been done in this country towards the erection of concrete buildings.

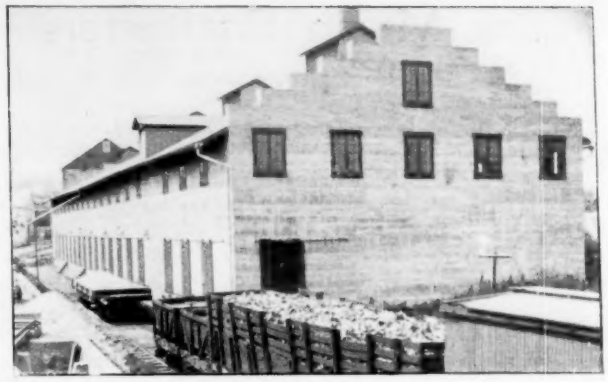
The Pennsylvania Railroad Company during the past year built concrete culverts under their roadbeds, in place of the stone culverts used previously. Mr. Jos. U. Crawford, chief engineer of branch roads, informed the writer that he considered the use of Portland cement concrete very advantageous for this class of work. The work can be pushed forward very much quicker than with brick or rubble masonry, and costs but one half. The abutments of these culverts were made of one part American Portland cement, one part limestone dust, three parts boiler ashes, and six parts crushed stone; the arch being a little richer in cement. The abutments are 12 ins. thick and the arches 3½ ins. thick at the crown; one has a 2 ft. span and the other a 4½ ft. span. A wire netting, costing five cents per square foot, is stretched over the lagging of the arch and becomes imbedded in the concrete. The limestone dust was used in the concrete as a filler, it being very close at hand and inexpensive.

The city of Reading, Pa., in their new sewers, have adopted Portland cement concrete in place of the old materials, — brick and Rosendale cement, — previously used. This work has been done under the supervision of Mr. E. Chamberlain, city engineer. In Reading the character of the soil is well adapted for concrete construction, being of a clayey nature and enabling the shaping of the sides of the ditch to conform to the outside lines of the sewer section. A section plan at manhole is shown in Fig. 1.



From the springing line down, the ditch is excavated to the neat outside lines of the sewer by the use of a templet. After the first 12 ins. of the concrete bottom is made, the inside centers are placed in position, and the lagging, which is made of 2 ins. by 3 ins. by 16 in. strips, is carried up to the springing line with the concrete side walls of the sewer, the layers of concrete being about 6 ins. in depth. The arch centers are then placed in position with the same sized lagging. The outside surface of the arch is given the proper shape by bracing 4 in. or 6 in. strips to the sides of the ditch. The centers are generally left in place about twenty-four hours, or until all refilling has been done, after which the plaster coat is put on. The following is a copy of specifications for mixing the concrete: —

Concrete shall be composed of one part Portland cement, passing required tests, three parts clean, sharp sand, free from dirt or loam, and six parts of broken stone; stone to be of good quality, free from dirt or clay. Quarry strippings will not be allowed. All stone must be broken so that the longest side shall not exceed 1½ ins. Sand and cement shall be thoroughly mixed dry and then wetted and worked to the satisfaction of the engineer, after which the stone shall be added and mixed with the mortar. The concrete shall then be placed in the work, in layers of not more than 6 ins., and rammed until it flushes. Concrete must be mixed by hand. The concrete must be allowed to set at least twenty-four hours before any refilling is done. The inner surface of concrete sewer must have a finished coat of one part Portland cement, passing required test, to two parts of clean, sharp sand.



CONCRETE STOCK HOUSE, SAYLOR'S PORTLAND CEMENT WORKS.

The work was all done with American Portland cement, and the sewer, which was built last year, is giving entire satisfaction. The cost of the 7 ft. 6 ins. by 5 ft. 0 ins. sewer is about $8 per lineal foot.

There are very often culverts and buildings to be erected by large manufacturing establishments, who have quantities of cheap materials at hand, which could be utilized in concrete, which would very materially lessen the cost of the structure, if Portland cement concrete was used for the construction. In the spring of 1894 Mr. Chas. M. Saegar, A. M. A. S. C. E., built a storehouse and culvert of this construction at the "Saylor's Portland Cement Works," Coplay, Pa. The culvert is about 250 ft. long, and is used to carry the surface drainage from the ground back of the mill, as well as the waste water from the mill to the Lehigh River. In some places it is covered with dirt 20 ft. thick.

The boiler-house and boilers, concrete stock house, and the coal trestle and dump are built on this culvert. Fig. 2 shows section plan of the culvert. The materials used were one part "Saylor's" American Portland cement, two parts clean, sharp sand, and four parts boiler ashes. This was made up in the form of concrete and deposited in a casing made of rough boards, in layers of 6 ins., and in this concrete were imbedded all the large pieces of limestone (strippings of the quarry, unfit for cement making) that could be rammed in; this was covered with concrete and rammed; then another layer of stone was firmly pressed in and again covered with concrete, and so on. The arch was made in precisely the same manner as this, only that care was taken to place the longest line of the stone in line with the radius of the circle. Care was also taken to have 2 or 3 ins. of coating of concrete directly on the boards, so as to show a smooth surface when the centering was removed. The floor of the culvert is made of the ash concrete, about 4 ins. thick.

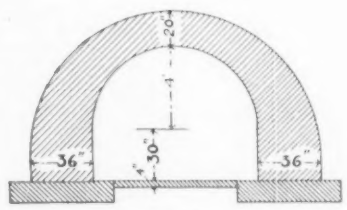


FIG. 2.

The stock house, which is built in the same manner as the culvert, is 250 ft. by 50 ft. The walls are 2 ft. thick for the first 16 ft., up to the second floor; from there up they are 18 ins. thick. The first floor will carry 25,000 bbls. of Portland cement and the second floor 15,000 bbls.

The above method of construction shows remarkable strength, considered with the cheap materials used, and it could be readily utilized to great advantage by many who have such waste materials at hand when building.

WM. G. HARTRANFT.

The Mason Contractors' Department.

Conducted in the Interests of the Builder and the Contractor for Brickwork.

CRACKS IN BRICKWORK AND PLASTERING.

WHAT CAUSES THEM, AND HOW THEY MAY BE PREVENTED. (*Continued.*)

BY A. H. DYER.

AN ordinary store-front having a continuous footing of equal width will quite often show the effects of unequal settlement to such an extent as to seriously affect the value of the property, as well as to give the building a reputation of being unsafe. Fig. 8 is an exact representation of the front of a two-story brick building

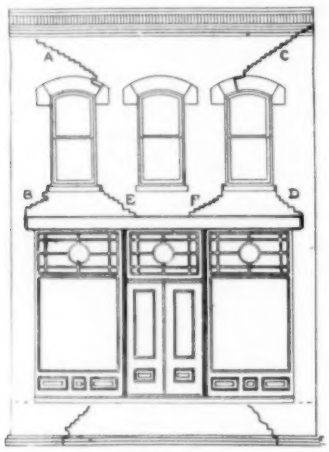


FIG. 8.

built upon a continuous footing and in the same manner as shown in Fig. 1. The cracks A, B, C, D began to show at about the same time, the two upper ones working toward the corners in a nearly uniform manner. As the corners continued to settle, the outer ends of the lintel settled enough to cause cracks E and F, as shown. As usual, the cause of these cracks was attributed to an insufficient area of footings, the width of same being but 20 ins., and the wall 12 ins. thick the entire height of the building. No part of the weight of the floors or roof was brought to bear upon this wall, and it will be seen that the weight of the brickwork alone for the entire height of the wall would be but 2,180 lbs. upon each square foot of footings, which is considered to be a very moderate load; but at the center of one of the large window openings the load would be but 253 lbs. per square foot, provided, of course, that no weight from the piers on either side was brought to bear upon that point; in a shallow foundation, as in this case, very little if any additional weight would be distributed as far as the center, and in no way would it be possible to distribute an additional weight of 1,927 lbs. per square foot to that point, so that the load would be the same as at the piers or corners, which would be necessary in order to insure an equal settlement in case of any settlement at all, for the simple reason that the weight at that point lacks more than *six tons* of being heavy enough, just the same as shown in Fig. 3, that the "inverted arch" lacks five tons of being heavy enough to take the place of the five tons that had been entirely removed from the wall. In Fig. 9 we have the same width of footings as in Fig. 8, but we have only about *four ninths as much total area of footings;* but we have practically a uniform load for each square foot of footings, and the maximum load per square foot is no greater than that in Fig. 8. If we should increase the width of the footings fifty per cent., making them 30 ins. instead of 20 ins., the load per square foot upon the bottom footings would be decreased fifty per cent., but *the difference in loads would be in the same ratio as before.* It makes no difference whether the

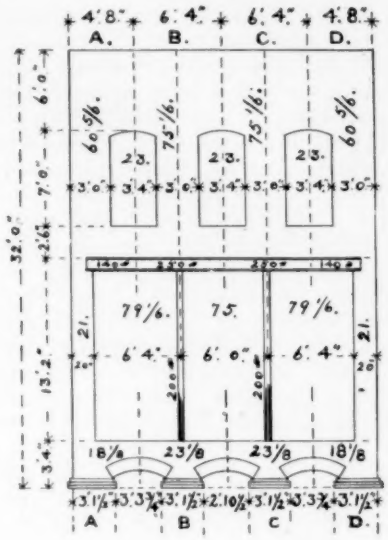


FIG. 9.

footings are of brick, stone, or concrete, they should be properly proportioned and no part of them should be loaded with eight *times more weight* than other parts of a like area, as is practically the case with Fig. 8. It will be noticed that only the weight of the brickwork and the iron work was taken into consideration when figuring the loads of Fig. 9. The writer recently examined a one-story public building having large double windows near each corner and in both directions from the corner, which gave unmistakable signs of unequal settlement. The building is a handsome one of stone and rests upon a heavy concrete (continuous) foundation, and, although finished but eight months ago, each of the corners shows a tendency to pull away from the building, as shown by the open joints and cracks in the masonry from the walk line up to the window-sills and from the top of the opening up to the top of coping on the side of windows nearest the corners. All corners show these defects in about the same degree; there is a difference of 1,200 lbs. per square foot in the loads of the masonry alone; a 30 in. "cut out" below the center of each double window would have caused the loads to be uniform throughout. The load per square foot at the corners figures 3,031 lbs. for masonry alone, while below the center of the opening the same figures but 1,830 lbs.; with this difference in loads the heavy concrete footing did not enforce an equal settlement, but all four corners of the building proved defective in about the same degree. This is another example of *too much foundation.* A one-story brick and stone depot building but recently completed already shows the same defects as above, notwithstanding the fact that the wall rests upon footing stones *four feet wide, but continuous under all openings.* In the vicinity of all of the above buildings, and upon the very same quality of ground, buildings upon brick foundations, constructed upon the same principles as shown in Fig. 9, stand without a single crack caused by unequal settlement, although some of them have but one half or two thirds as much total area of footings in proportion to the weight of the building as the above-mentioned buildings in which the foundation has proved to be defective.

WANTED.— A partner, by a mason doing a large and profitable business. Must have $5,000 to invest, and furnish good references. A thorough investigation is courted. Address, Mason, care of THE BRICKBUILDER PUB. CO.

SIDE TALKS WITH THE BUILDER.

THERE are many builders who have a practical knowledge of brickwork and know how to construct an excellent piece of brickwork, but are careless or ignorant regarding that most important part of every building, and that upon which their structure depends most entirely. A poor *stone wall* has been the cause of ruining many a noble and otherwise perfect edifice. Let me give my brother masons a few pointers on laying stone — not that I shall attempt in these columns to give an exhaustive treatise on the subject, but simply to place before him a few simple rules, which may possibly be the means of saving him many dollars.

Of whatever quality the stone may be of which a wall is to be built, it should consist as much of stone and as little of mortar as possible. If it be inferior in durability and power in resisting the action of the atmosphere, etc., to the mortar, besides the certain fact that the mortar will yield until it has set hard, and so far act injuriously, no ulterior good is gained; and if the stone be the more durable material, the more of it that enters into the wall the better. Indeed, in rough walling, if the stones be laid so that the most prominent angles on their faces come into actual contact, the interstices being occupied by mortar, it will be better than if a thick, yielding mass were allowed to remain between them. Absolute contact, however, should not be permitted any more than in brickwork, lest the shrinkage of the mortar in drying leave the stones to such unequal bearing as the prominent parts alone would afford.

Stone being generally of a less absorbent nature than brick, it is not a matter of so much importance that it be wetted before setting. Nevertheless, adhesion on the part of the mortar is more certain and more complete if the stones be worked in, at least, a damp state.

Bond is of not less importance in stone walling than in bricklaying. Instead of carefully making the joints recur one over the other, in alternate courses, as with bricks and gauged stones, the joints should as carefully be made to lock so as to give the strength of two or three courses or layers between a joint in one course, and one that may occur vertically over it in another. In bonding *through* a wall or transversely, it is much better that many stones should reach two thirds across alternately from the opposite side than that there should be a few through stones, or stones extending the whole thickness of the wall. Indeed, one of the many faults of stone masons is that of making a wall consist of two scales or thin sides with through stones now and then laid across to bind them together, the core being made of mortar and small rubble merely. This is a mode of structure that should be carefully guarded against. There is no better test of a workman's tact and judgment in rubble walling than the building of a dry wall, or a wall without mortar, affords.

Walls are frequently built with mortar that without it would have fallen down under their own weight in a height of 6 ft., in consequence of their defective construction, thus rendering it evident that they are only held together by the tenacity of the mortar, which is very seldom an equivalent for a proper bond of stone. Masons are very apt to set thin, broad stones on their narrow edges to show a good face, by which the wall is injured in two ways. It tends to the formation of a mere case on the surface of a wall, and it for the most part exposes the bed of the stone to the atmosphere, as a stone more likely to be broad in the direction of its bed than across it.

One of the severest trials builders have to encounter is the architect, who is well versed in the technical conception or planning of a structure but is not acquainted with its practical construction. I do not, however, make this a sweeping charge, as there are many capable men throughout the country who fully understand the practical side of building construction.

I would urge here, as I have always done, that if the modern architect is to live his highest life, and see the fulfilment of his noblest conception, he must go down into the byways and loiter in the highways, and seek out, learn, comprehend, and be able to apply to his art every handicraft engaged therein.

He must go into minute details of methods, of skilled labor, and even master the mystery of the nineteenth-century mechanisms, which play such a more and more prominent part in all that is done and all that is hoped to be designed.

If the workman be the tool by means of which the design is to be wrought, then he who conceives the design must know most fully the breadth of the skill that is to operate the tool. Indeed, he must have had some experimental knowledge himself before he can conceive and carry out his best work or have others execute it for him. But this is not all. In placing himself in direct contact with the artisan who is trying to interpret his feeling, the artisan catches more and more of the spirit, of the animus, of the creative power which conceived the design; the skill, which, by years of cunning practise, has crept into his hand, and which has developed more by instinct than by an impulse of purely intellectual incitation, becomes quickened by this contact with the finer human fiber, and soon there is a generous rivalry, as between the power of execution and that of conception. When architecture and handicrafts have arrived at such a relation, then shall the world witness the birth of another Phidias, Michael Angelo, Paul Veronese, or Christopher Wren. It may be that this ideal is purely Utopian; but we may promote the good work that would ensue from a more friendly attitude to the handicrafts by taking and showing more interest in the technical execution of architectural work, by requiring better workmanship, and by giving a preference to artisans who take a pride in their skill, and who love, as the architect does, beautiful handiwork.

No architect who appreciates the close relations between the details as the finish of his art and the composition of its entirety as the expression of his ideal but will see how intimate is the connection between the hand that executes and the brain that conceives.

To be in most sensitive touch with this expression, the architect must either be a craftsman himself, modeling with his own finer fingers, or else have that delicate mental insight which can perceive and direct how, and where, and when the alluring line or the subtle surface shall appear.

With the numerous so-called architects grinding out plans by the yard, I am afraid the architectural profession has too much to contend with in this country. The following contents of a professional (?) circular, quoted by an English journal, however, shows a degradation which can hardly be considered amusing. This choice extract reads: —

"As competition is very great in our day, I submit for my clients' approval sketch designs (free of charge) of any class of buildings they intend to erect or are interested in, upon receiving particulars of their requirements."

The circular concludes with the reiterated announcement: "Designs of any buildings sent free of charge."

R. N. Buell.

Since the latter part of the last century the power of the great River Connecticut has been kept in harness at Holyoke, Mass., and from time to time dams have been built, according to the needs of the manufactories on the banks of the river.

A new dam, in the construction of which neither money nor labor is spared, is now being built under the direction of the Holyoke Water Power Company; the contractors for the work being the Fruin-Bambrick Construction Company and Henry S. Hopkins, of St. Louis, Mo. The enterprise was begun in the summer of 1893, and the intention is to build a dam second to none in the world.

It will be 1,020 ft. long and 32 ft. high, with a width of 54 ft., containing 50,000 cu. yds. of masonry; 30,000 horse-power will be furnished by this great dam when completed.

Much time is needed to construct this immense wall of masonry that is to hold back the waters of the river, and three years is the time allowed for its completion.

An immense quantity of cement will be used in this work, and we are informed by Mr. J. N. Sickman, the engineer in charge, that the Alpha Portland cement, an American product, has been specified exclusively.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

THE accompanying illustration is of the New York Commercial Building that is now being erected on the site of the old New York Hotel, Broadway, New York City. When completed it will be one of the finest of modern structures. The front is of brick and beautifully molded terra-cotta, there being over five hundred tons of the latter used, all of which is white.

A notable feature in connection with the Broadway elevation is the size of the terra-cotta capitals which are used in the ninth story, they being 5 ft. in height. On Plate 58 is illustrated the scale drawing of the elevation and a group of the terra-cotta capitals used. Mr. Robert Maynicke is the architect, and Mr. Isaac A. Hopper, the builder. The terra-cotta was executed by the Excelsior Terra-Cotta Company, of New York.

CHICAGO. — "Bicycles in architecture" is a subject already demanding a certain amount of attention. Restaurants are advertising "Wheelmen's Rest," and provision for storing wheels must be made in office buildings, clubs, gymnasiums, Y. M. C. A. and even church buildings, not to mention special cycling clubs, buildings for more than one of which are planned or under construction in this city. No wonder an architect's work is fascinating when we think of the constant changes and modifications in modes of living and their direct effect on architecture. These are what makes the history of architecture interesting. Refrigerating machines and elevators are bringing us phases of buildings not dreamed of by Ruskin and Viollet-le-Duc.

NEW YORK COMMERCIAL BUILDING, NEW YORK CITY.
Robert Maynicke, Architect.

The free and easy use of building permits in Chicago has been referred to before in these columns. The latest item of interest was in connection with the proposed Northern Hotel, office and theater building. The permit was refused at first on the double ground that the building is to exceed the limit of height (130 ft.) allowed by the present ordinances, and that the old permit taken out before this ordinance went into effect did not contemplate a theater in the building. Both these points were easily avoided, however, by allowing the hotel and office part of the building to proceed under the three-year-old permit and by issuing a new permit for the theater part of the building, which is itself less than 130 ft. high.

Chicago needs a Roosevelt. Even under the new administration, about which we expressed great hope, it is easy to evade laws; one can build a wood construction bay window in the heart or the business center of the city, or he can project a show window 3 ft. on the most crowded sidewalk, if he only uses a little "oil."

New York has not a monopoly of building disasters. The recent complete collapse here of the "Coliseum," — an amusement building somewhat like the Madison Square Garden, but of a cheaper order, — would have made a great stir had it happened two hours sooner than it did, in which case two hundred men would have been killed or maimed. As it was, not a man was injured when the great steel trusses of the half-finished roof fell one night and made a cyclonic tangle of planking and twisted steel work, and caused a loss of some $75,000 or $100,000. The collapse seems to have been the result of too much "rushing," but whether it was a defective bearing plate on the inclined pile foundation, or an overload of roof lumber on an unfinished truss, or both, does not seem as yet to be determined.

A carriage manufactory at 381 Wabash Avenue has a party wall (still unused from one side) which settled 5 ins. more than the rest of the building, and with such effect that a bay of the front had to be taken down and rebuilt. Miscalculation for foundations on Chicago soil is serious.

An architectural feature of a new office building already mentioned is to be two terra-cotta caryatids, each (probably an Atlas) carrying an eight-story building on his shoulders. Whether the contemplation of this building will give one a backache is an open question; but at any rate the architect protested when the owner insisted on introducing this feature in the design.

The alterations of important buildings in the business part of Chicago outnumber the erection of new ones this year. The removal of tenants to the attractive new office buildings makes it imperative for owners to "modernize" their buildings, since conditions will not justify razing the old structures and erecting others in their stead. Hence the very numerous places about town where jackscrews are in view and new fronts, entrances, and elevators are being put in.

The "Reaper Block" and the "Major Block" are two of the largest buildings undergoing repairs. The fronts are stone in "Renaissance" design. Two or three stories of terra-cotta are added, and the result is so successful (at least, in the case of the Reaper Block, now finished) that one regrets the millions of dollars' worth of substantial and even fire-proof buildings built since the great fire which have lately been torn down to make way for modern office buildings.

A large church, heavy spire and all, is to be moved bodily 50 ft. More particular mention will be made when the feat is undertaken. A number of such difficult projects have been carried out successfully; one that may be recalled was the moving of a 100 ft. square three-story apartment house a block and turning it 90 degrees in transit.

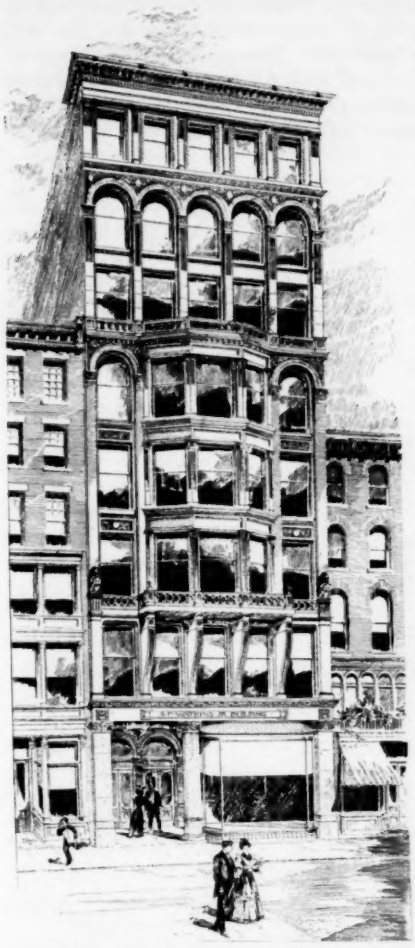
One or two announcements of new buildings are as follows: —

$125,000 apartment building for Judge R. Prendergast, Flanders & Zimmerman, architects. Bedford stone and Roman brick, and terra-cotta trimmings and cornice. No elevators, electric door openers. Bicycle storage.

A new apartment building for Barry & Tellerus, Cowles & Ohrenstein, architects.

The Northwestern Terra-Cotta Company have the contract for the Fisher eighteen-story building.

The American Terra-Cotta and Ceramic Company are furnishing the terra-cotta for the big Yerkes Observatory.



OFFICE BUILDING, 1031 CHESTNUT ST., PHILADELPHIA.
Albert W. Dilks, Architect.

PHILADELPHIA.—A building thoroughly adapted to present uses and rivaling in beauty and utility some of its much more extensive competitors is the one recently finished at 1031 and 1033 Chestnut Street, designed by Architect Albert W. Dilks; it shows more than ordinary study in the planning of the eight floors composing the building, and has an abundance of light and air.

It is constructed with a steel frame between extra heavy party walls, care being taken to thoroughly protect every part of the frame from fire and rust. The stories are very high, probably higher than necessary for the ordinary uses to which they will be put, but were made so in order that there might be freer light and ventilation. Aside from the stairways, which are of iron with aluminum finish, the front on Chestnut Street is the only place upon which any ornamentation could be attempted, and here there has been a combination of stone, brick, and terra-cotta very neatly and carefully designed and executed. The detail especially is better than the usual work of this class, and in the building looks very much more interesting than in our sketch, the position of the building being such that it is almost impossible to get a good photograph of the front at present.

A very noticeable feature is the large vestibule or entrance to the building, which is faced from floor to ceiling with faience in specially designed pattern. The novelty of the material attracts the attention of the passing public, and is quite favorably commented upon. It was furnished by the Grueby Faience Company, of Boston, Mass., and is of the most extensive and finest of their executions which we have seen.

The brick and terra-cotta is from the New York Architectural Terra-cotta Company, while the terra-cotta arches and blocks are from the Staten Island Terra-cotta Company. The elevators are of very high speed, and were erected by the Stokes & Parrish Company. The steel work was made by the Phœnix Iron Company.

The extremely hot weather seems to have had a depressing effect upon the boom which has been running since the early spring, and there is at present more attention given to the buildings now in course of erection than to those projected. There are well-founded rumors of some new, large contracts about to be let; the Mutual Life Insurance Companies, of New York, are about ready to commence, as is also the Baptist Publication Society. Both will be very large buildings. The Harrison and Fidelity Insurance Companies' office buildings and the Hotel Walton are rapidly nearing completion, and the Franklin Building is about finished.

The time for the submission of the competitive drawings for the new Art Museum, in Fairmount Park, is rapidly approaching; they are due on the first of October. A supplement to the original program was issued several months ago, which threw considerable additional light upon the former circular. It is to be hoped that it will be more of a success than some of the recent competitions in our neighboring cities.

BUSINESS CHANGE.—The information comes to us that Mr. O. W. Ketcham, formerly of the New York and Philadelphia offices of Fiske, Homes & Co., has opened in his own name an office in the Builders' Exchange in Philadelphia, for the sale of building materials of all kinds, especially brick, terra-cotta, etc. He will continue to represent Fiske, Homes & Co., the Grueby Faience Company, the Excelsior Terra-cotta Company, and the Pennsylvania Enameled Brick Company, in Philadelphia and vicinity, as well as other large houses throughout the country.

MINNEAPOLIS.—The present outlook for building operations is much brighter than at last reports. An immense crop now being harvested gives assurance of an abundance of the necessaries of life, and the money required to harvest and move this crop will give labor and the railway companies all they can do. The impetus thus imparted extends generally and gives all a feeling of assurance that the worst is over. There is a notable increase in elevator construction all over the Northwest. We confidently expect a very considerable increase in the volume of our business before winter sets in.

Warren H. Hayes has planned church building for the Union Square Baptist Society, of Boston, Mass.; 77 by 120 ft., to be built of brick and granite at cost of $35,000.

In residences the following:—

For Charles E. McMullen, an apartment building to contain eight apartments, at cost of $40,000. A. L. Darr, architect.

S. G. Cook is completing a $20,000 residence begun some time ago, and "hung up" during the recent depression; 40 by 70 ft.,

GRACE CHAPEL BUILDINGS, NEW YORK CITY.
Barney & Chapman, Architects.
250,000 gray bricks used in these buildings were furnished by the Eastern Hydraulic-Press Brick Co.

three stories and basement. Brownstone, brick, and terra-cotta. H. W. Jones, architect.

A. M. Fish is building a 40 by 60 ft. three-story residence on "Lowry Hill," to have ten rooms. Will be faced with "Kelley" cream brick, made by Northern Hydraulic-Press Brick Company. Cost, $10,000. Orff & Joralemon, architects.

For a special subject this month I have chosen the Hugh Harrison Wholesale Building, a fine example of business architecture, not surpassed in the Northwest. (See plate 61.) A six-story and basement building with a plinth course of St. Cloud granite. Body of the building is faced with a new Roman mottled manganese brick, of buff tone, furnished by Northern Hydraulic-Press Brick Company. The window jambs and quoins are treated with a darker brick of same make. The building has a composition roof and a cornice of copper and brick. The interior is of mill construction, structured iron furnished by Gillette-Herzog Company, of Minneapolis. Has three crane elevators, Wolff's sanitary appliances, and Porter Bros.' steam heating apparatus.

COLUMBUS, O.— There seems to be a marked revival in building in the city, and many things indicate a good fall and a busy spring. Two new business blocks are under way, and others are being planned, while several small churches and residences are also in process of erection. One of the very worst and most discouraging signs of the times — in building — is the large number of dilapidated old fire-trap structures which are being rehabilitated (?) with paper, paint, etc. During the past season no less than a dozen structures of this description have been treated with new fronts of galvanized iron and stamped metal, — made up into forms to imitate classic details,— with "*bran new*" elevators, etc., etc., until the wayfaring man would imagine we had several new modern structures,— judging from the outward appearance. Some new work, however, is being done.

OFFICE BUILDING, BROADWAY, BROOME, AND MERCER STS., NEW YORK CITY.
John T. Williams, Architect and Owner.
Face Brick furnished by the Sayre & Fisher Co.

Architect Elliot reports plans completed for a five-story hotel or apartment building to be erected for Mr. Frank Powell. The building will be fire-proof, built of brick, terra-cotta, and steel. The face brick will be Roman pressed brick. The building will cost $125,000.

Architects Yost & Packard report plans out for a German church, to be built of brick, with stone trimmings. Cost, $6,000.

Architect Terral reports a five-story factory, 190 ft. by 72 ft., to be built of brick.

ROCHESTER.— The fall season promises little in building circles this year. There is just enough work to keep things moving and that is all.

Messrs. J. G. & J. W. Cutler have let contracts for the erection of a three-story building, to front on East Main Street, East Avenue, and Belmont Park. It will be a continuation of the building erected by them a few months ago, and will be of a dark gray brick, furnished by the New York Hydraulic-Press Brick Company. This building will eventually be seven stories high.

The building for the Liberty Improvement Company will soon be completed, and it is expected to be ready for tenants by the middle of November. It is built of pressed brick and terra-cotta. The pressed brick was furnished by the New York Hydraulic-Press Brick Company, and the terra-cotta by Perth Amboy Terra-cotta Company. Architect, J. Foster Warner.

Mr. George T. Otis, architect, is having plans figured for a manufacturing building to be built for Mr. J. C. Lighthouse, on Mansion Street. The same architect is preparing plans for the First Presbyterian Church, at Mendon. It will be English Gothic in style, and will cost about $10,000.

This has been a busy year for the architects who make a specialty of manufacturing buildings. Messrs. Charles S. and Harvey Ellis have erected six of these, four of which are built of pressed brick and terra-cotta, and two are fire-proof. The average height is six stories. Messrs. Ellis are also preparing plans for two other buildings, which will soon be announced.

DETROIT. — Each succeeding week sees increased activity in the western and southwestern suburbs of Detroit, and visitors to the city and others who desire to find where the industrial pulse of the metropolis beats rapidly and strong must visit the section located near the Rouge River.

Any attempt to describe the busy scenes must necessarily fall short of the actuality. Beginning half a mile north of Wyandotte, several hundred men have been at work all the past week, constructing the switches from the Michigan Central Railroad to the new plant of J. B. Ford & Company, and last week the siding was filled with cars, loaded with material for the buildings that will nearly cover the 125 acres.

Coming nearer to Detroit, one finds the mills running night and day on orders for material for the many new buildings contemplated and in course of construction all along the line of the Detroit & Wyandotte Electric Road.

A mile east, ground is being broken for a $1,000,000 factory by Canadian capitalists.

Next comes the great Solvay Process Company, which is hard at work on the old exposition grounds, preparing for what will unquestionably be the largest soda ash factory in the world.

The State Board of Education have adopted plans by Malcomson & Higginbotham for the new State Training School, for which the last legislature appropriated $25,000.

Plans are out for a magnificent apartment house and family hotel, which will shortly be built in Detroit, if satisfactory arrangements can be made for a site. The building is estimated to cost $150,000.

HENDRICKS' *Architects' and Builders' Guide* has made its annual appearance. It is a volume of over 800 pages, containing the names and addresses of over 200,000 architects, builders, and manufacturers of all materials kindred to building, given in alphabetical order. New York, S. E. Hendricks Co. Price, $5.00.

The Architects' Directory for 1895–96, by the same concern, containing a list of the architects in the United States and Canada, classified by States and towns, giving the architectural associations to which they belong, has, the publisher states, been prepared with great care to secure accuracy of both name and location. Bound in red boards, gilt title, 16mo, price, $1.00.

THE Competition drawings are now being exhibited at the Chicago Architectural Club. Manufacturers should encourage a large attendance at these exhibits as they are good arguments for the use of brick and terra-cotta in city houses.

MANTEL DESIGNED BY GEORGE B. ROGERS.
Executed in Faience by the Atwood Faience Company.

MR. WM. CONNORS, Troy, N. Y., the well-known manufacturer of "American Seal" Mortar, Stains, and Roofing Cement, authorizes us to announce a competition for the best design for an advertisement to be used in THE BRICKBUILDER. The wording which is to be incorporated in the design may be found in Mr. Connor's advertisement for this month on page xxiv.

The drawings must be made in line with black ink on sheets cut to the uniform size of 4 by 11 ins. Each drawing must be marked with a motto or cipher, and a sealed envelope similarly marked, containing the full name and address of the designer, must accompany the drawings. These envelopes will not be opened until after the award is made. The designs for which prizes are awarded will become the property of Mr. Connors.

For the best design, there is offered a first prize of $25, a second prize of $15, and a third prize of $10.

The prizes will be awarded by a jury of three gentlemen competent to judge of this class of work.

Drawings must be delivered flat, express or postage prepaid, at the office of THE BRICKBUILDER, not later than October 1.

THE accompanying illustration is of a mantel executed in faience by the Atwood Faience Company, of Hartford, and is taken from the very attractive and artistically gotten up catalogue which they have recently issued.

A very pretty bit of work recently done by this company is the name and date for the new Odd Fellows Hall, Waterbury, Conn.; Wilfred E. Griggs, architect. The face of the letters is enameled in a golden yellow, and the background in a darker color, to harmonize with the Pompeian terra-cotta of which the building is built.

THE Pioneer Fire-proof Construction Company, of Chicago, are getting out a 17 ft. arch which will be used in the Occidental Building now being erected in that city. This, we think, is the largest arch that has ever been made, and will be fully illustrated and described in a later number.

To see the list of buildings for which this company has furnished fire-proofing during the past year one would not think that building operations had been particularly quiet in the West. Some of the more important contracts taken were for the Fisher, Occidental, and Reyerson buildings, Kenwood, Straus, and Irving apartments, and Drovers' Bank, Chicago; St. Joseph's and St. Luke's Hospitals, St. Paul; Lonsdale office building, Duluth; New City Hall, Davenport, Iowa; Lincoln Telephone Building, Lincoln, Neb.; Shawnee County Court House, Topeka, Kan.; Hutchings and Sealy office buildings, Galveston, Texas.

THE new catalogue of the Sayre & Fisher Co. is a most attractive and complete volume relating to the manufacture and use of all kinds of building brick.

Its contents are of a very interesting character, comprising a large number of fine half-tone illustrations of prominent buildings which have recently been erected in New York City and elsewhere; also, a most interesting list of well-known modern buildings (giving the names of architects of same) which have been erected in many of the large cities. The color plate of fancy "fronts" and enameled bricks are exceedingly well done, and gives one a very good idea of the texture as well as the color of the bricks. A large variety of molded brick is shown with sizes of same.

Not the least interesting feature is the illustration of brick mantels, all the dimensions of which are printed below the illustrations.

In compiling this catalogue no expense or pains have been spared, and it is a worthy representative of this well and favorably known concern.

THE regular six months' winter course of the Academy of Architecture and Building, St. Louis, Henry Maack, principal, begins October 1. This is its tenth school year. The course of study offered is an excellent one, and can be mastered in one year by those students who have received a thorough grammar school education, ready for high school, and have besides a few years' experience in a building trade or in an architect's office, and study with absolute application. For all others the time must be liberally extended. According to ability, it will take them from one to six months longer to finish the full course.

A NEW carton or wrapper for protecting enameled brick in transit has been invented and introduced by the Thompson & Norris Co., of Brooklyn, N. Y. They seem to fill a long-felt want, and are being used to a great extent by the manufacturers of glazed and ornamental brick.

OFFICE

KULAGE MACHINE WORKS,

ST. LOUIS, MO.

Messrs. BRICKMAKERS,
United States and Canada,

Gentlemen:—We would herewith call your attention to the following, viz.:

We manufacture the Kulage Brick Press, which is the celebrated "Triumph" Dry Clay Press Brick Machine. We guarantee this press to be without an equal. The "Triumph" has a capacity up to 35,000 plain or shaped pressed bricks in ten hours, has four distinct or quadruple pressures, has solved the problem of a twin, or top and bottom pressure, without the center seam streak or granulation; is simpler, stronger, and built upon better scientific principles than any other dry clay brick press on the market. The price of a "Triumph" press is $5,500, which entire amount may be saved or gained during the first year of operation in the superior quality of its product, capacity, and economy of operation, and as compared with that of other presses.

We construct and equip brick plants of any capacity complete, and in this connection would say that we manufacture the "Triumph" Loading Machine—also a money maker for the brickmaker. This machine gathers the previously plowed and dried clay from the field and loads same into carts or wagons. With two or three horses and one driver, its capacity is the gathering and loading of as much clay as twenty men with shovels would do. The benefit of one machine to a certain brick concern during this season is calculated to be over $4,000.

We like to correspond with progressive brickmakers. Yours respectfully,

KULAGE MACHINE WORKS,
North Broadway and College Ave., St. Louis, Mo.

HERE IS ONE

Representation of a FIREPLACE MANTEL. Our Sketch Book, containing 39 others, will be sent you on application.

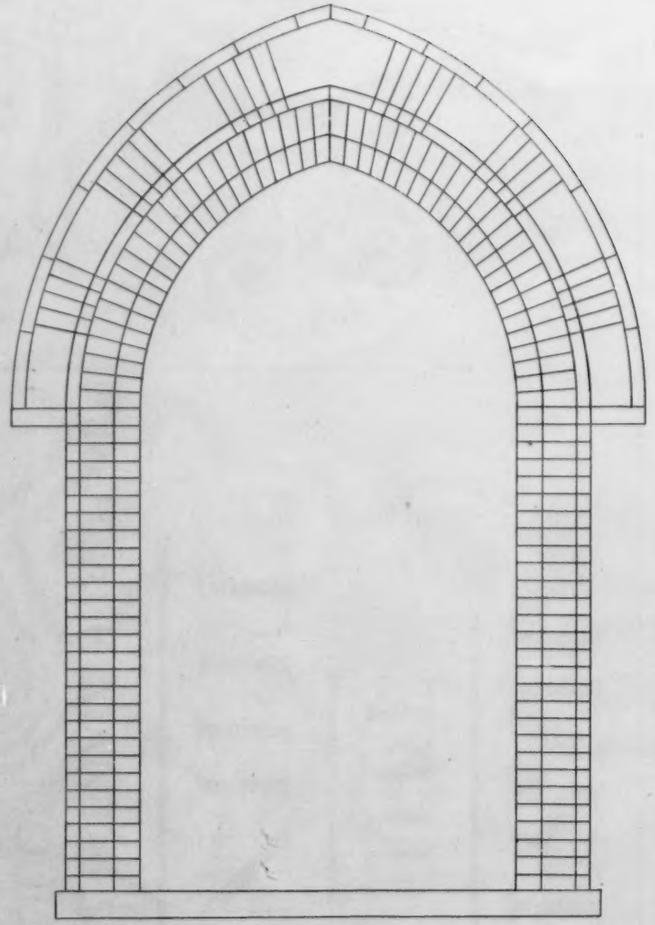
JUST THE THING

FIREPLACE MANTELS MADE OF MOULDED BRICK

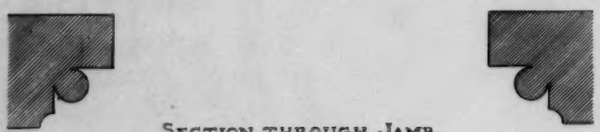
In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

PHILA. & BOSTON FACE BRICK CO.,

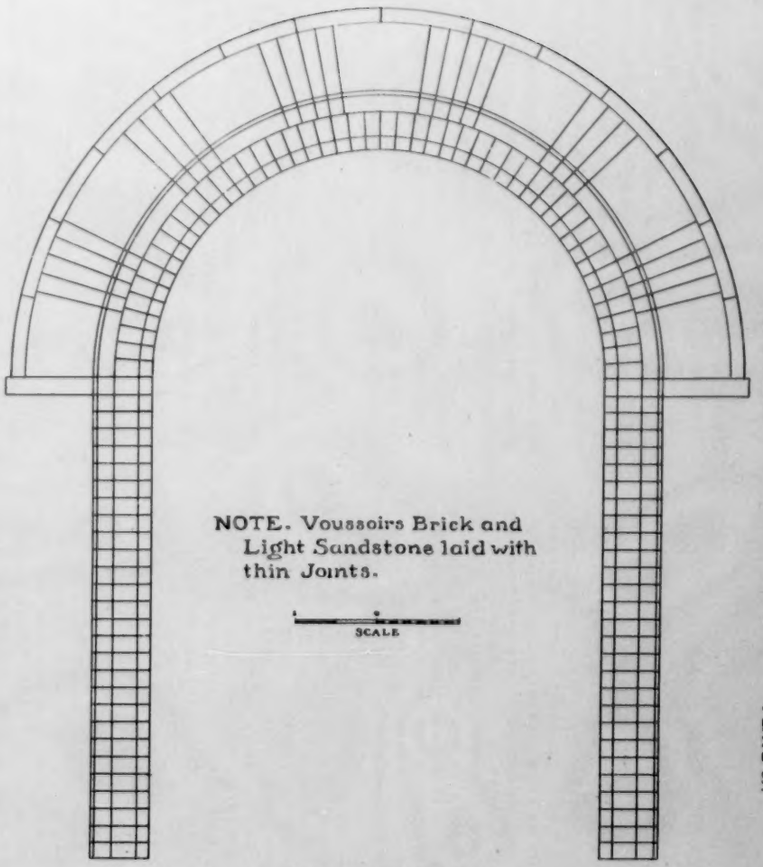
No. 4 LIBERTY SQUARE, BOSTON, MASS.



ELEVATION.



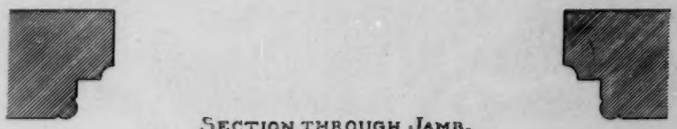
SECTION THROUGH JAMB.



NOTE. Voussoirs Brick and Light Sandstone laid with thin Joints.

SCALE

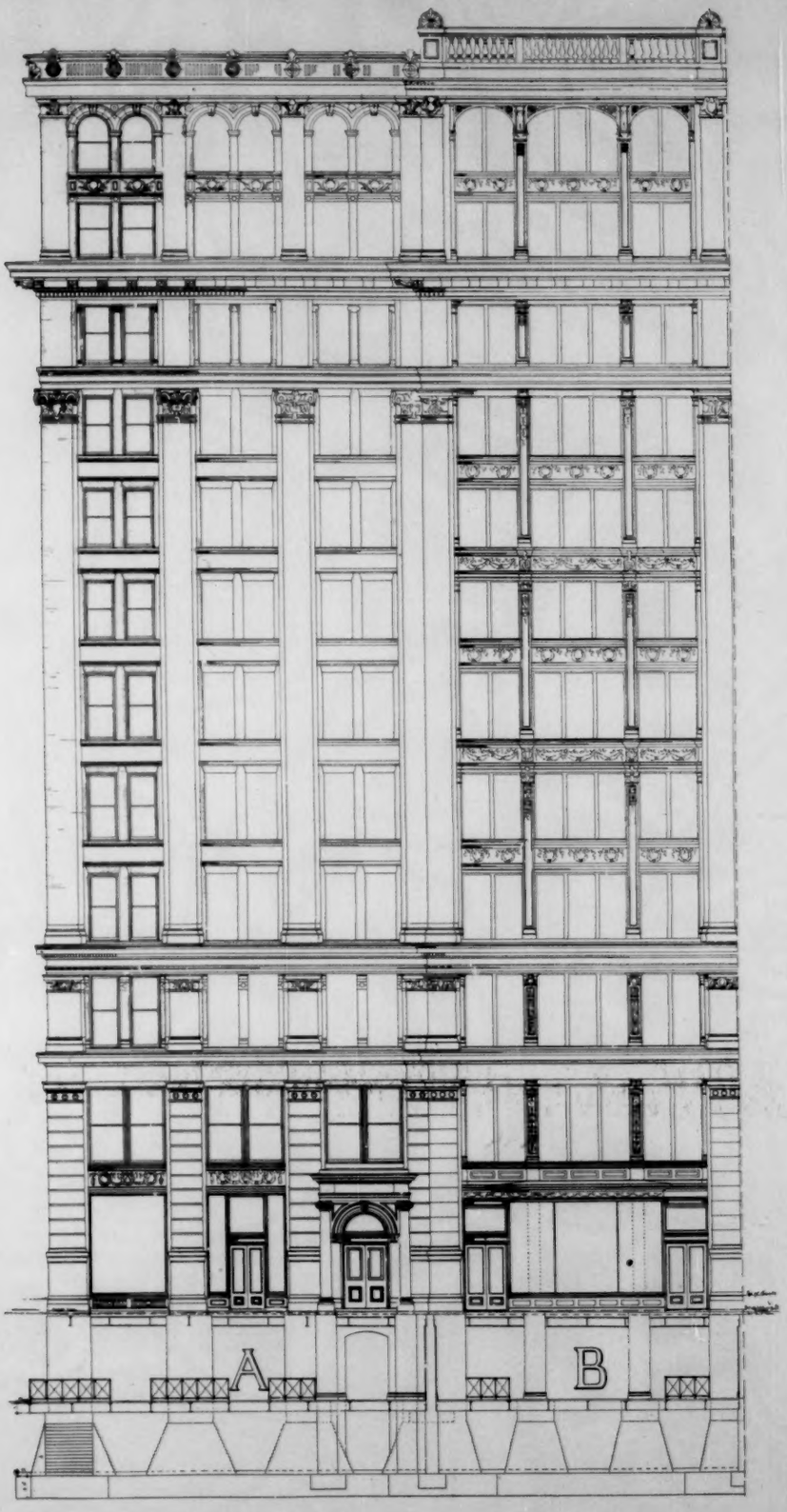
ELEVATION.



SECTION THROUGH JAMB.

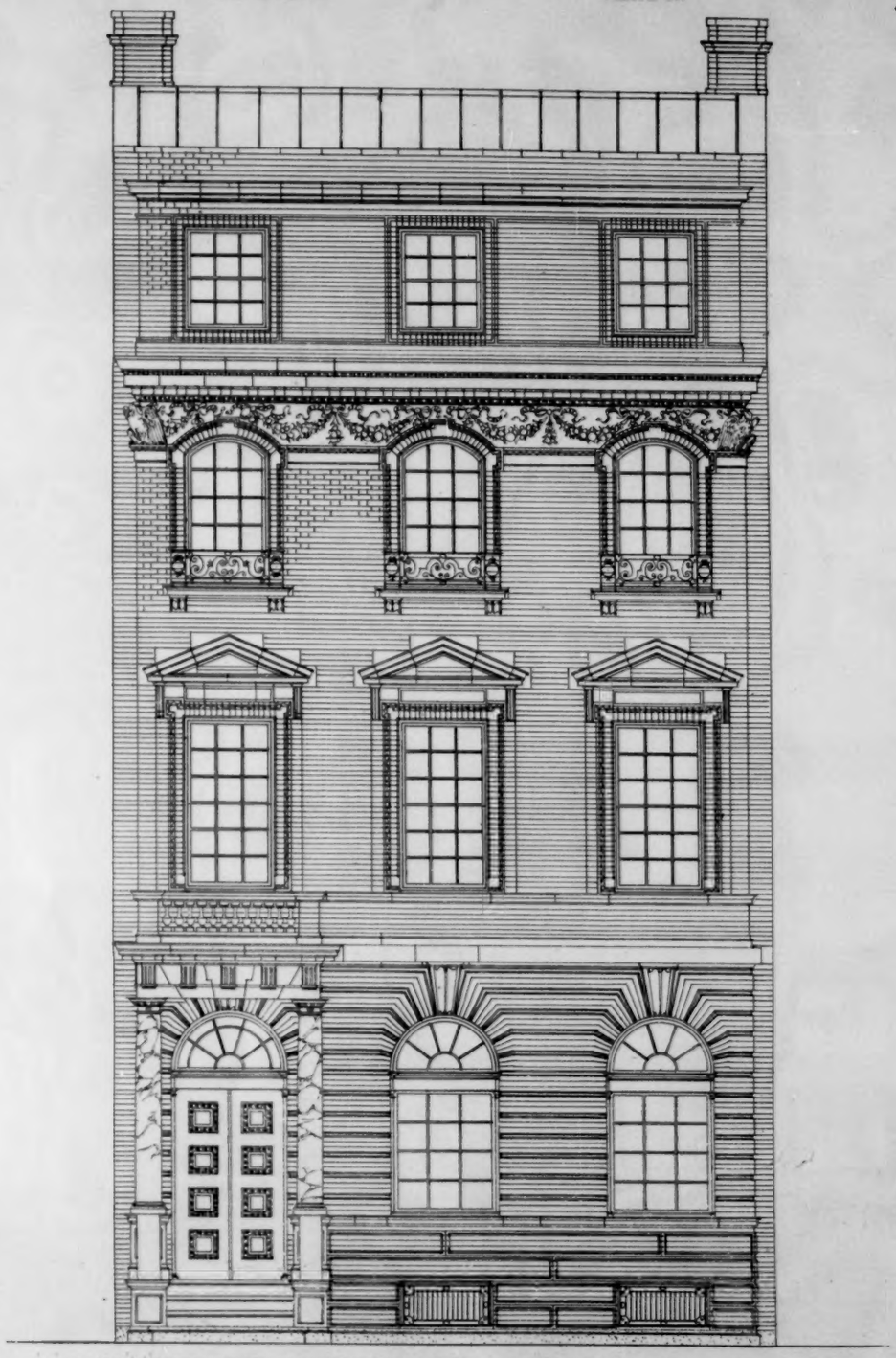
MEASURED DRAWING OF WINDOWS OF HOUSE ON VIA ARCHE ACALIGERE, VERONA.

SERIES OF TERRA-COTTA CAPITALS USED IN THE NEW YORK BUILDINGS.



BROADWAY ELEVATION, NEW YORK BUILDINGS (SITE OF THE OLD NEW YORK HOTEL).

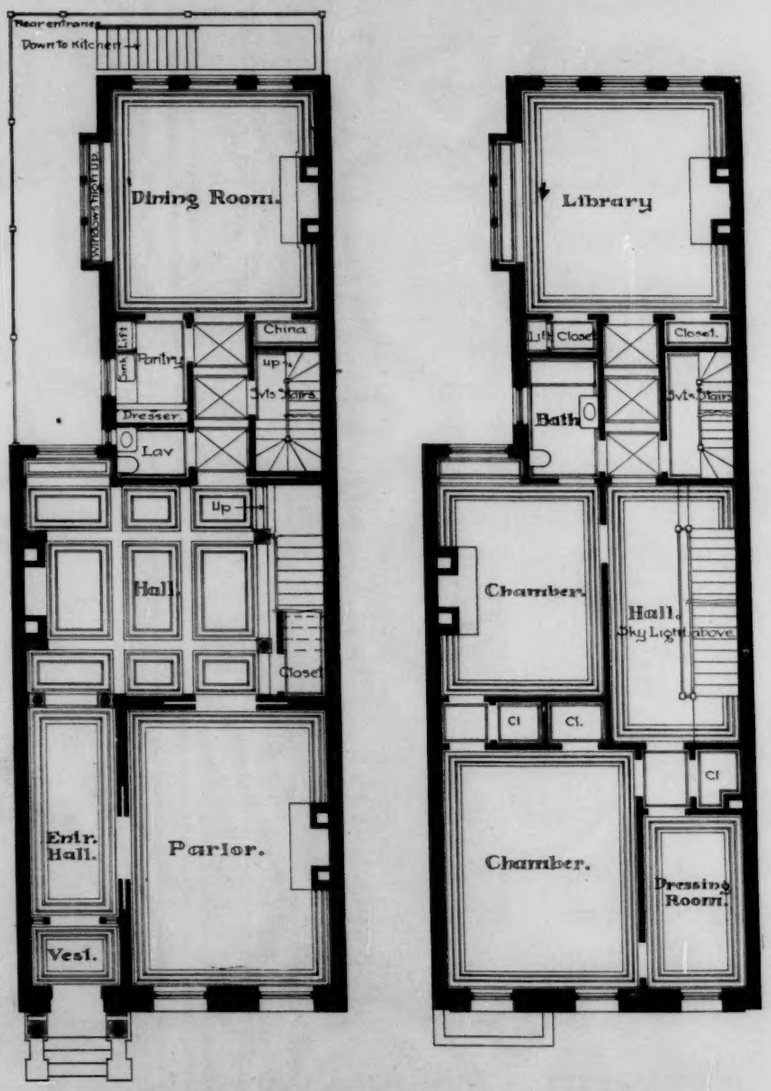
R. MAYNICKE, ARCHITECT.



BRICKBUILDER COMPETITION FOR A CITY HOUSE. SECOND PRIZE.

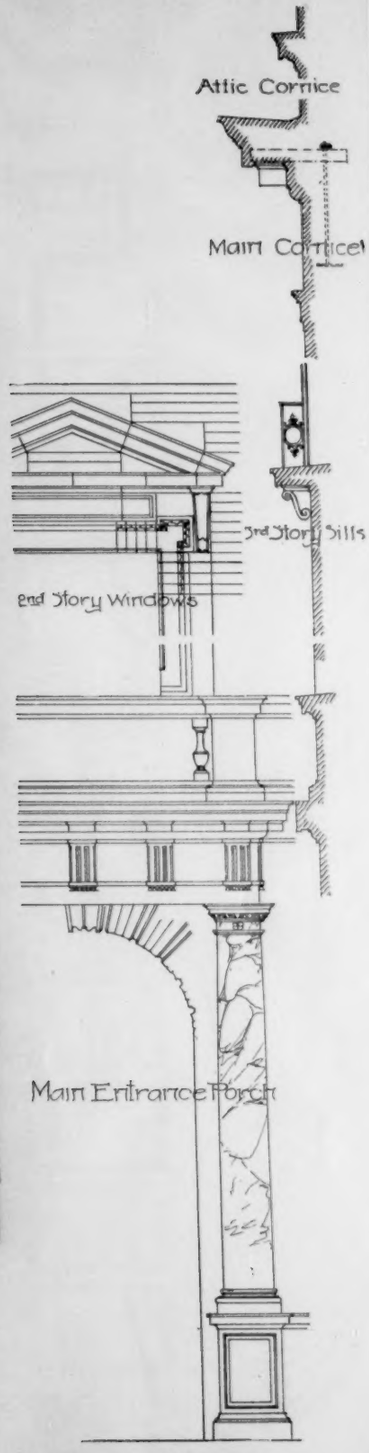
EDWARD E. HENDRICKSON, PHILADELPHIA, PA.

"BRICK BUILDER" COMPETITION



First Floor Plan. Second Floor Plan.

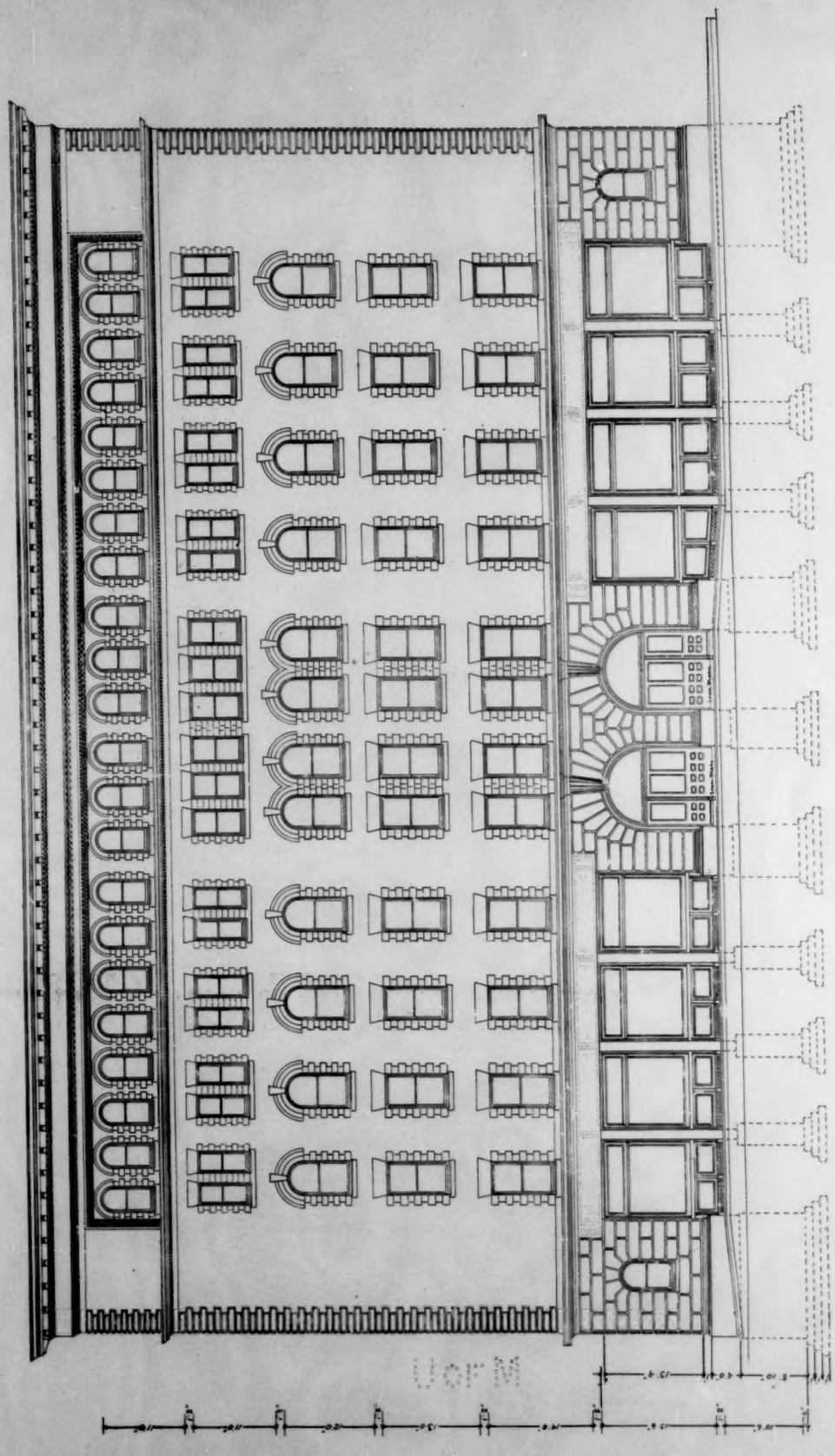
By "Wren"



Details of Front.

BRICKBUILDER COMPETITION FOR A CITY HOUSE. SECOND PRIZE.

EDWARD E. HENDRICKSON, PHILADELPHIA, PA.



HARRISON BLOCK, MINNEAPOLIS, MINN.
WARREN H. HAYES, ARCHITECT.

WATER TOWER, STATE HOSPITAL, TOLEDO, OHIO.

E. O. FALLIS, ARCHITECT.

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